United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R05-92/209
September 1992

EPA

Superfund Record of Decision:

Clare Water Supply, MI

NOTICE

The appendices listed in the index that are not found in this document have been removed at the request of the issuing agency. They contain material which supplement, but adds no further applicable information to the content of the document. All supplemental material is, however, contained in the administrative record for this site.

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA/ROD/R05-92/209	2.	3. Recipient's Accession No.
4. Title and Subtitle SUPERFUND RECORD OF DECISION Clare Water Supply, MI Second Remedial Action - Final			5. Report Date 09/16/92
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12. Sponsoring Organization Name and Address U.S. Environmental Protection Agency 401 M Street, S.W. Washington, D.C. 20460			13. Type of Report & Period Covered 800/000
			14.

15. Supplementary Notes

PB93-964106

16. Abstract (Limit: 200 words)

The Clare Water Supply site is a municipal well field in the City of Clare, Clare County, Michigan. Land use in the area is predominantly commercial, industrial, and residential with wetlands neighboring the site. In addition, a drainage ditch runs through an industrial area directly northwest of the site across the well field, discharges into the wetlands, and recharges the underlying aquifer. An estimated 3,300 residents of Clare use the municipal water supply as their drinking water supply. In 1981, state investigations of the municipal wells showed VOC contamination in the ground water. In 1982, soil samples taken during the installation of monitoring wells showed soil contamination from seven industrial facilities bordering the well field and attributed contamination of the shallow perched aquifer to the leaching of contaminants from these areas. A 1990 interim action ROD for the site provided for air stripping to remove VOCs from the city's water supply. The air strippers were installed and began operating in 1991. This ROD addresses the contaminated soil and ground water as a final remedial action for the site. The primary contaminants of concern affecting the soil and ground water are VOCs, including benzene, PCE, TCE, and xylenes.

(See Attached Page)

17. Document Analysis a. Descriptors

Record of Decision - Clare Water Supply, MI
Second Remedial Action - Final
Contaminated Media: soil, gw
Key Contaminants: VOC (benzene, PCE, TCE, xylenes)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 54
	20. Security Class (This Page) None	22. Price

(See ANSI-Z39.18) See Instructions on Reverse

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

Abstract (Continued)

The selected remedial action for this site includes treating 54,800 cubic yards of soils by implementing institutional controls, constructing an in-situ vapor extraction (ISVE) system to remove VOCs from soil and sediment; constructing ground water extraction wells, treating contaminated ground water by UV/chemical oxidation, and reinjecting treated ground water into the aquifer. Air emissions from the ISVE will be treated by granular activated carbon (GAC) filters, which will be regenerated offsite. The total present worth cost is estimated at $11,754,247, including an average annual O&M cost of $431,183 over a 30-year operational period.

PERFORMANCE STANDARDS OR GOALS: Chemical-specific soil clean-up goals are based on protection of ground water and include benzene 20 ug/kg; vinyl chloride 0.4 ug/kg; TCE 60 ug/kg; PCE 14 ug/kg; methylene chloride 100 ug/kg; trans-1,2-DCE 2,000 ug/kg; cis-1,2-DCE 1,400 ug/kg; xylenes 6,000 ug/kg; toluene 20,000 mg/kg; ethylbenzene 1,000 mg/kg; 1,1-DCA 14,000 mg/kg; 1,2-DCA 8 mg/kg; 1,1,2-TCA 12 mg/kg; 1,1,1-TCA 4,000 mg/kg; and styrene 20 mg/kg. Chemical-specific ground water clean-up goals are based on SDWA MCLs, and state MCLs under Michigan's Act 307 Type B Cleanup Levels and include benzene 1 mg/l; vinyl chloride 0.02 mg/l; TCE 3 mg/l; PCE 0.7 mg/l; methylene chloride 5 mg/l; trans-1,2-DCE 100 mg/l; cis-1,2-DCE 70 mg/l; xylenes 300 mg/l; toluene 800 mg/l; ethylbenzene 70 mg/l; 1,1-DCA 700 mg/l; 1,2-DCA 0.4 mg/l; 1,1,2-TCA 0.6 mg/l; 1,1,1-TCA 200 mg/l; and styrene 1 mg/l.

RECORD OF DECISION

FOR THE SECOND OPERABLE UNIT

AT

THE CLARE WATER SUPPLY SITE IN

CLARE COUNTY, MICHIGAN

September 16, 1992

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Clare Water Supply Site
Clare, Michigan

STATEMENT OF BASIS AND PURPOSE

This decision document presents the United States Environmental Protection Agency's (U.S. EPA's) selected remedial action for the Clare Water Supply site located in Clare, Michigan. The remedial action was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Contingency Plan (NCP). This decision is based upon information and documents contained in the administrative record for this site.

The State of Michigan Department of Natural Resources concurs with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this decision document, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

This response action addresses remediation of soil and groundwater contaminated with Volatile Organic Compounds (VOCs) at the Clare Water Supply Site. The principal threats posed by conditions at the Site include ingestion, inhalation, and dermal absorption of VOCs through use of supplied water and contact with contaminated soils. The selected remedy will eliminate these threats.

The major components of the selected remedy include:

1) In-Situ Vapor Extraction of Volatile Organic Compounds (VOCs) from contaminated soil areas;

2) Extraction of contaminated groundwater, treatment using Ultraviolet Photochemical Oxidation, and reintroduction of treated groundwater into aquifer system.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action or meets the conditions necessary to justify a waiver of such requirements, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Because this remedy will result in hazardous substances remaining on-site above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Valdas V. Adamkus — 9/16/92.

Valdas V. Adamkus
Regional Administrator

Date

STATE OF MICHIGAN

JOHN ENGLER, Governor

DEPARTMENT OF NATURAL RESOURCES

Stevens T. Mason Building, P.O. Box 30028, Lansing, MI 48909

ROLAND HARMES, Director

September 16, 1992

Mr. Valdas V. Adamkus, R-19J
Administrator, Region 5
U.S. Environmental Protection Agency
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Dear Mr. Adamkus:

The Michigan Department of Natural Resources, on behalf of the State of Michigan, has reviewed the proposed Record of Decision (ROD) for the Clare Water Supply Superfund site, Clare County, Michigan, which we received on September 8, 1992. We are pleased to inform you that we concur with the remedy outlined in the draft ROD for the site.

The major components of this remedy include:

* Institution of deed and/or access restrictions as necessary.
* Diversion of the US-10 drainage ditch around contaminated sediments while the remedial action is being conducted.
* Soil vapor extraction of volatile organic compounds from contaminated soil areas.
* Extraction of contaminated groundwater and treatment using the ultraviolet photochemical oxidation system.
* Discharge of treated groundwater to injection wells located upgradient of the site, or to the Clare POTW, or to the Tobacco River.
* Regular monitoring of system performance.

The State of Michigan also concurs with the analysis of legally applicable or relevant and appropriate requirements contained in the Statutory Determinations section of the ROD.

If you have questions regarding this site, please contact Mr. Brady Boyce, Superfund Section, Environmental Response Division, at 517-373-4824, or you may contact me.

Sincerely,

Russell J. Harding
Deputy Director
517-373-7917

cc: Mr. James Mayka, EPA
Mr. Jon Peterson, EPA
Mr. Alan J. Howard, MDNR
Mr. William Bradford, MDNR
Ms. Denise Gruben, MDNR
Mr. Brady Boyce, MDNR

9/16/92

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DECISION SUMMARY

SITE NAME, LOCATION, AND DESCRIPTION

The Clare Water Supply is in the southwestern quadrant of the City of Clare, Michigan; in the southeast 1/4 of Section 34, Township 17 North, Range 4 West of Grant Township, Clare County, Michigan. The Clare Water Supply system withdraws groundwater from four municipal wells (MW) in the area, each tapping an unconsolidated sand aquifer which occurs between approximately 30 to 80 feet below the surface. Two of the wells, MW #2 and MW #5, are located in the northeastern portion of the site. Based on sampling since 1981, these wells have been shown to be contaminated. The contaminants in these wells consist primarily of chlorinated hydrocarbons. Two uncontaminated wells, MW #6 and MW #7, are located generally south and southwest of the contaminated portion of the site, respectively. The Clare Water Supply is the Public Water Supply for the 3,300 residents of Clare, Michigan. This has been found to be the only feasible source of drinking water for the community.

West of the contaminated wells, approximately 14 manufacturing and retail businesses are operating. It appears that several of these facilities may be or have been the location of contamination source areas. Current or past operations which contributed to the contamination include lagoon disposal, underground and above ground tank storage, and drain tile discharges from two of the facilities.

The site is generally bounded to the north by 5th Street (U.S. Highway 10). The western boundary of the site roughly corresponds to the western side of the Mitchell Property, and the wellfield is bounded to the east by Maple Street (Figure 1). The Ann Arbor railroad line traverses the site from the south to north and the C&O Railroad line crosses the site at the northwest edge. The Little Tobacco Drainage ditch flows across the wellfield entering from the southern border of the industrial area located directly west-northwest of the municipal wellfield. The drainage ditch is spring fed before it enters the industrial area and receives input from surface runoff. The flow in this drainage ditch is intermittent and it rarely exceeds a few inches in depth. The drainage ditch empties into a small wetlands area which directly recharges the aquifer in the vicinity of the two contaminated wells.

The site soils create two different hydrologic regimes within the investigation area. The first hydraulic regime consists of a perched water zone created by the low-permeability clay/till unit(s) in the western half of the site. The second is created by aquifer sand underlying till. The aquifer is 20 to 40 feet thick in a sand unit beginning at 30 to 40 feet below the ground surface. In the western, industrialized portion of the site, 30 to 40 feet of clay and glacial till cover the aquifer. In the eastern well field portion of the site, the aquifer sand joins a thick sequence of river channel sands which extend from the ground surface to approximately 80 to 90 feet below ground surface, based on drilling logs.

Flow from the drainage ditch infiltrates the soils at the western edge of the well field. On the eastern edge of the wellfield, surface flow from the Little Tobacco drainage ditch joins the Little Tobacco River and continues eastward. Other local surface water includes the Tobacco River, approximately one-half mile north of the well field, and Shamrock Lake, approximately 1 mile northeast of the well site.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

In December, 1981, the Clare municipal wells were sampled by the Michigan Department of Public Health (MDPH) for organic compounds. The sampling revealed Volatile Organic Compound (VOC) contamination in MW #2 and MW #5. The contaminants were identified as chlorinated hydrocarbons and included trichloroethene (TCE) and dichloroethene (DCE). The MDPH determined that the aeration process which the city used to remove iron from the drinking water and blending of the water from the contaminated wells (MW #2 and MW #5) with water from the uncontaminated well (MW #6) would effectively reduce the contamination in the water prior to distribution. Testing results indicated that the iron removal aeration treatment removed approximately 67% of the TCE contamination through volatilization during the forced draft aeration (45 parts per billion (ppb) before treatment, 15 ppb after treatment). DCE concentrations were not significantly affected by the aeration (11 ppb before treatment, 10 ppb after treatment). Blending of water from the least contaminated wells facilitated a further reduction in contaminant concentrations within the tap water system. Water was aerated and blended in this manner before delivery until completion of the interim action operable unit which has provided for air stripping of all water pumped from MW #2 and MW #5 since March 7, 1991.

Well log data from a 1982 monitoring well drilling program conducted by the Technical Assistance Team (TAT), a contractor working on behalf of the U.S. EPA, established the existence of clay lenses that covered the area west of the municipal wellfield. Soil samples from the industrial area indicated grossly contaminated soils near at least four industrial sites.

This short-term study indicated that the major sources of soil and groundwater contamination were most likely located directly west of the well site in the industrial area. Contaminants are believed to be leaching out of soils on the industrial properties, entering a shallow perched aquifer, and migrating to the deeper aquifer that serves the municipal wellfield. Contaminants appear to be transported by both surface water (the drainage ditch) and groundwater flow pathways.

In November 1982, the Clare site was evaluated using the Hazard Ranking System (HRS) and was then proposed to Group 7 of the National Priorities List (NPL). The site was listed as final on the NPL on September 21, 1984.

In September 1984, the MDNR requested that a Remedial Investigation/Feasibility Study (RI/FS) for the Clare Water Supply be initiated in fiscal year 1985. Concurrent to this request, a short-term hydrogeologic investigation was conducted by the MDNR. The objective of the MDNR's study was to identify potentially responsible parties (PRPs) so that they could be requested to undertake the RI/FS.

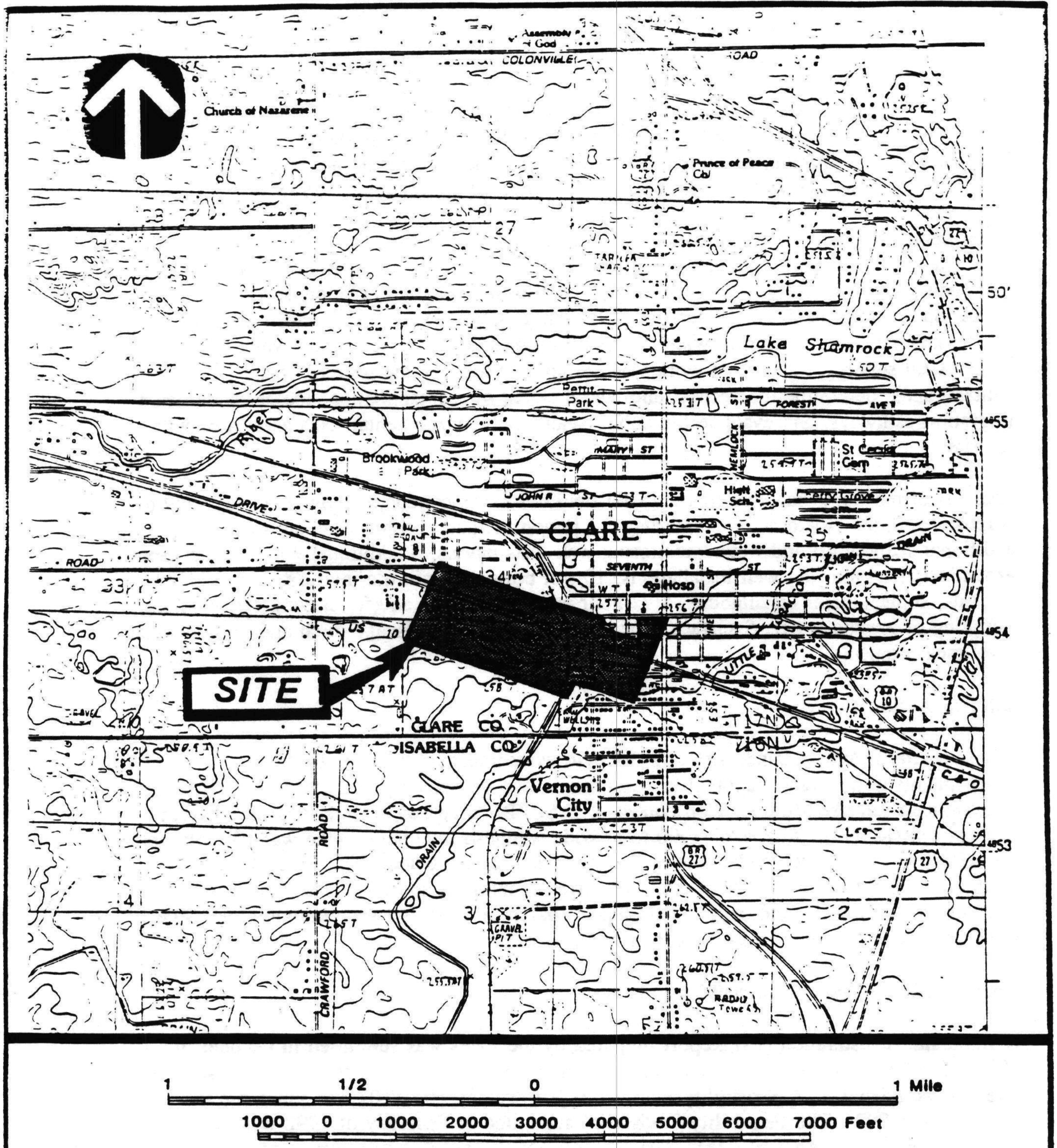


FIGURE 1

POOR QUALITY ORIGINAL

CLARE WELL FIELD RI/FS
CLARE, MICHIGAN

SITE LOCATION MAP

U.S.G.S. QUADRANGLE MAP
7½ MINUTE SERIES (TOPOGRAPHIC)
CLARE, MICHIGAN
PROVISIONAL EDITION 1983.
R-4-W: BETWEEN T-16N AND T-17N.

On September 27, 1985, a Consent Order was signed, binding the U.S. EPA and the PRPs: Colt Industries (now Coltec), Ex-Cello Corporation, Ransburg Corporation, and United Technologies Automotive, to complete a RI/FS at the Clare Water Supply field in Clare, Michigan. The Remedial Investigation (RI) was initiated in September, 1988.

From September 6, 1988 to November 12, 1988, the following Phase I field work was completed by the PRPs: installation of 24 shallow (5-7 feet deep), 11 intermediate (18-47 feet deep), and 4 deep (55-105) groundwater monitoring wells; completion of 41 soil borings; collection of 6 sediment and 12 surface water samples from the Little Tobacco Drainage Ditch; sampling and measuring water levels of all ground-water monitoring wells; and geophysical surveys. This field work was designed to identify the sources of the contaminants, determine the vertical and lateral extent of contamination, locate contaminant migration pathways, and evaluate the public health and environmental risks associated with the site.

Phase II of the Remedial Investigation (RI) field work was conducted from June 13, 1989 to August 16, 1989. Field activities during this period included geophysical surveys, 4 additional shallow ground-water monitoring well installations, 6 additional intermediate depth groundwater monitoring well installations, 10 soil borings, drain tile investigations with 14 test pits, 6 piezometer installations, a 72 hour pump test of the aquifer serving the wellfield, sampling of ground water, 5 surface water samples from the drainage ditch and ground water level measurements.

Interim Action

The sampling results obtained from the RI field work indicated that the levels of contaminants in the water supplied to consumers were approaching or equal to the Maximum Contaminant Levels (MCLs). Consequently, U.S. EPA prepared an Interim Action Record of Decision (ROD) in August of 1990 to provide wellhead treatment of the water supply until the RI/FS was completed and the overall site remedy implemented. The ROD selected air stripping of the city water supply as the preferred remedy for the interim action. The air strippers were installed and began operating in March of 1991 and are removing over 90% of the volatile contaminants from the City's water supply.

Remedial Investigation / Feasibility Study

A Remedial Investigation (RI) Report prepared by the PRPs was submitted in October of 1990. The results of this report are summarized below in the section entitled "Summary of Site Characteristics". A Feasibility Study (FS) prepared by the PRPs was submitted in February of 1992. The Feasibility Study (FS) submitted in February of 1992 was modified for clarity by U.S. EPA and released in May of 1992. The FS report evaluates a no action alternative, two minimal action alternatives involving the use of institutional controls and/or containment, two treatment alternatives for contaminated soil and two treatment alternatives for contaminated groundwater.

COMMUNITY PARTICIPATION

A fact sheet outlining the RI sampling program was distributed in August of 1988. An RI initiation public meeting was also held at that time in Clare. U.S. EPA issued a Proposed Plan for the Interim Action Operable Unit (Protection of City Water Supply) in June of 1990 and held a public meeting to solicit public comments on U.S. EPA's plan to have an air stripper installed on the City Water Supply in July of 1990. U.S. EPA held a public meeting in January 1991 to explain that the RI report had been made available for public review and to reveal the general results of the RI. The Feasibility Study (FS) and the Proposed Plan were both issued to the public on May 26, 1992.

All of the above documents, including the analytical data, are available in both the administrative record and the information repository maintained at the Garfield Memorial Library at 4th and McEwan Streets in Clare.

To elicit public comments on the USEPA's Proposed Plan and the other remedial alternatives evaluated in the FS, a comment period was held from May 27, 1992 through June 25, 1992. In addition, U.S. EPA held a public meeting on June 3, 1992 at 7:00 p.m. at Clare City Hall to present the alternatives evaluated in the FS and describe the combination of remedial alternatives presented in the Proposed Plan for this action. All comments which were received by EPA prior to the end of the public comment period, including those expressed verbally at the public meeting, were considered in making the final decision and are addressed in the Responsiveness Summary at the end of this Record of Decision.

SCOPE AND ROLE OF RESPONSE ACTION WITHIN SITE STRATEGY

U.S. EPA has organized this project into two operable units: The first operable unit was an interim action to address contamination of the drinking water supply by Trichloroethene (TCE) and TCE-degradation products (Record of Decision date August 18, 1990). The interim action provides wellhead treatment in order to maintain a safe drinking water supply and will continue as long as the levels of contaminants in the untreated supplied water equal or exceed any Maximum Contaminant Level (MCL).

The U.S. EPA has identified the principal threat to human health and the environment at the Clare Water Supply Site to be the contaminated soil areas shown in Figures 4, 5, and 6 which will be addressed in the second operable unit covered by this Record of Decision (ROD). The contaminated soil is the major remaining source of groundwater contamination. The selected remedy is anticipated to be the final remedial alternative to be implemented at the site unless other sources are identified. The groundwater plume and contaminated soils will be treated in accordance with applicable or relevant and appropriate requirements of Federal and State law. In addition, the U.S. EPA considers treatment of the contaminated soil, which is the source of groundwater contamination and is a principal threat, to be the most practicable remedy at this time.

A third operable unit may be necessary to address other potential source areas should they be identified. The results of the RI suggest that there may be other source areas contributing to the groundwater contamination at the Clare Site. The owners or operators of several businesses in the vicinity of the wellfield were contacted by U.S. EPA and asked to provide information concerning their use and disposal of solvents and/or cutting oils. The information supplied by these individuals did not confirm or deny that they represent additional sources of contamination. Further investigation and sampling will be conducted to determine if there are additional source areas present at the Clare Water Supply Site. If additional source areas are identified, they will be addressed by a third operable unit.

SUMMARY OF SITE CHARACTERISTICS

The Remedial Investigation prepared by the PRPs broke the Clare Water Supply Site up into seven (7) areas. Each of the 7 areas were named for the major industrial facility within that area that was thought to be a source of contamination based upon earlier investigations conducted by the U.S. EPA and MDNR. The location of each of these 7 areas within the wellfield is shown on Figure 2. Soil, ground water, sediment and surface water samples were collected and analyzed during the RI. The maximum levels of contaminants found in soil and/or groundwater within each of the 7 areas is listed in Table 1. The RI report contains all of the detailed analysis results for each well or boring in each of the 7 areas.

MITCHELL AREA: Two lagoons were formerly located on the south side of the Mitchell property, a larger cooling water lagoon to the east, and a smaller lagoon to the west. The smaller, westernmost lagoon was backfilled sometime between 1964 and 1972. The larger cooling water lagoon was backfilled with sand in 1983. In 1987-88, a source removal action was undertaken by one of the PRPs in this area under an order from the MDNR.

Samples from shallow surface soils were collected during both phases of the field investigation. These include borehole samples and test pit samples collected during the Drain Tile Study, which examined the possible influence of several drain lines on soil contamination in the lagoon area. The highest levels of contaminants were associated with the soils around the drain Tiles with trichloroethene as high as 1,100,000 ppb, trans 1,2-dichloroethene as high as 350,000 ppb. For more information on the soil contamination at the Mitchell area refer to Table 1 in this ROD and the Drain Tile Study which is Appendix 1 of the RI report.

The most highly contaminated groundwater under the Mitchell property was found at a depth of approximately 60 feet beneath the old lagoon area with trichloroethene as high as 4,600 ppb. Wells located just upgradient of the lagoon area at the same depth showed only low levels of contaminants. The 60 foot depth at this location coincides with the top of the lower aquifer on the western portion of the Clare Water Supply Site.

EX-CELL-O AREA: Twenty-two soil samples from above the till unit were collected on the Ex-Cell-O property, and seven samples were collected north and west of the Ex-Cell-O property. The highest levels of contaminants were located in shallow surface soils at borings taken just adjacent to the Ex-Cell-O building and under it with levels of trichloroethene in soil as high as 37,000 ppb and Xylenes as high as 31,000 ppb at a depth of 3 feet.

All wells in the vicinity of the Ex-Cell-O building were completed within or above the till unit. This discussion of ground water quality concerns only the perched water present above the clay. The highest levels of contaminants were found at 4-7 feet below the surface just south of the Ex-Cell-O building with trichloroethene as high as 20,000 ppb.

STANLEY OIL AREA: Soil samples were collected from borings during both phases of this investigation. A total of four such samples were collected from shallow soils in the Stanley Oil area. The highest level of chemicals found in these soil samples were Naphthalene at 7,000 ppb, xylenes at 3,600 ppb, toluene at 12 ppb, and methylene chloride at 18 ppb.

A total of four monitoring wells were installed in the immediate vicinity of the Stanley Oil area. The highest level of contaminants were found at 3-6 feet below the surface immediately adjacent to the aboveground storage tanks with benzene at 1,600 μg/l, ethylbenzene at 170 μg/l, xylenes at 1,000 μg/l, toluene at 42 μg/l, and methylene chloride at 7 μg/l.

MDOT AREA: Ground water samples were collected in the Ann Arbor Railroad depot area from three monitoring wells installed during the RI. The following compounds were detected in these monitoring wells: ethylbenzene at 460 μg/l, toluene at 310 μg/l; xylenes at 4,400 μg/l; trichloroethene at 7 μg/l; and methylene chloride at 4 μg/l.

Soil samples collected and analyzed by the MDNR in 1982 and 1983 in the MDOT area found soils to contain: ethylbenzene at 9,000 ppb, xylene at 90,000 ppb, toluene at 5,000 ppb, carbon tetrachloride at 410 ppb, and perchloroethane at 260 ppb.

WELTRONICS AREA: Fifteen soil samples were collected in the vicinity of the Weltronics building. The soils were found to contain up to: 130 ppb of trichloroethene, 57 ppb of toluene, 12 ppb of methylene chloride, and 110,000 ppb of bis(2-ethylhexyl)phthalate.

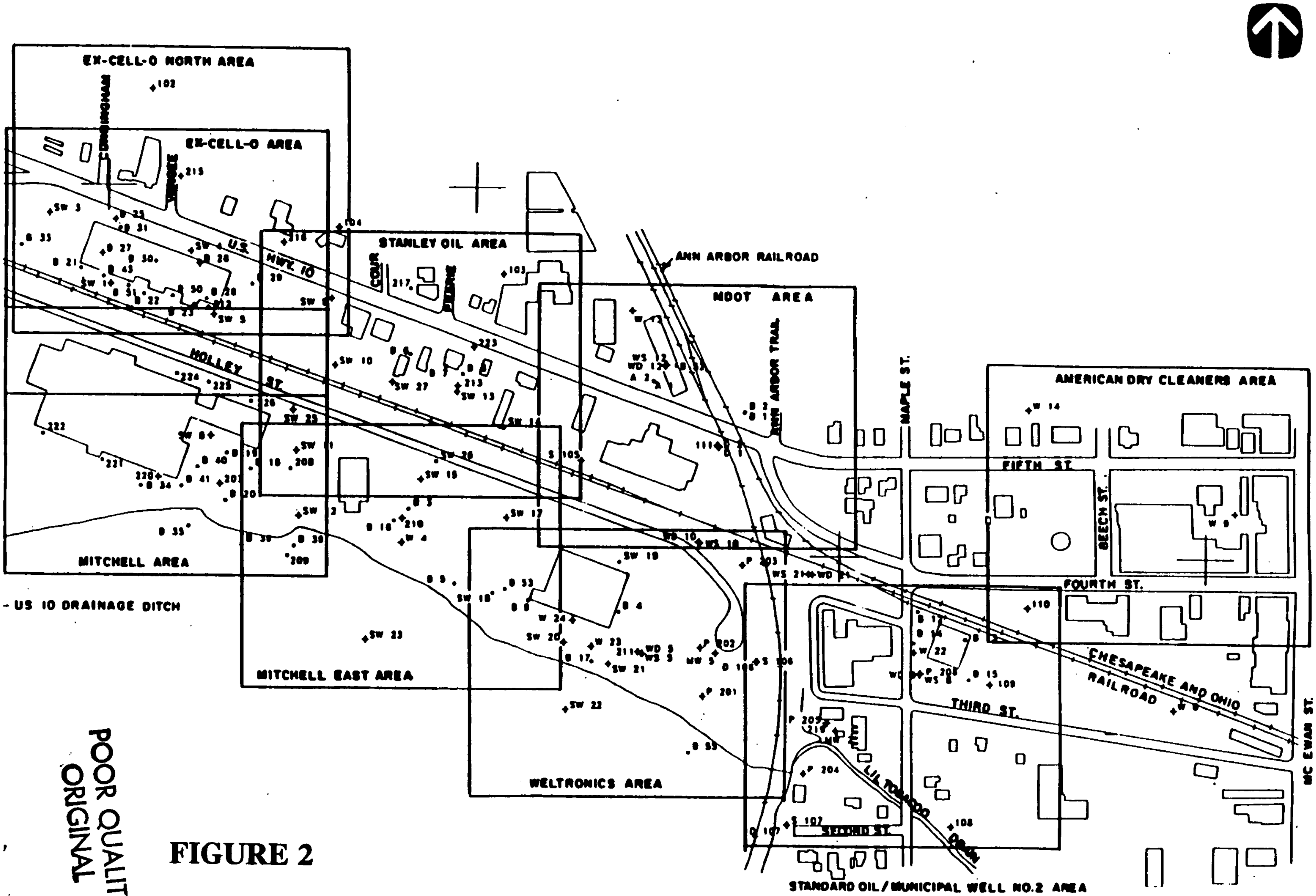
One of the soil samples taken from a waste pile near the Weltronics building during the RI revealed the presence of material which is classified by the Resource Conservation Recovery Act (RCRA) program as hazardous by "characteristic". The material is classified as "characteristic" because it has been tested using an Extraction Procedure (EP) to determine if toxic levels of compounds can leach out of the material into groundwater. In other words, it has been found to be EP toxic, which makes it a RCRA-regulated waste because it has a hazardous characteristic. The waste pile material was shown to have contained EP-toxic cadmium at 1.3 mg/kg and EP toxic lead at 25.90 mg/kg. The EP test has now been replaced with a more aggressive leaching test called the Toxic Characteristic Leaching Procedure (TCLP). Consequently, materials which were formerly tested using the EP test are likely to test "TCLP-toxic" since the TCLP involves a more aggressive leaching procedure. Additionally, references made to the EP characteristic may be replaced by references to TCLP characteristic. For example, the material which was found to be EP toxic at the Clare Site (discussed above in this paragraph) will have to be tested by the TCLP to see if it is TCLP toxic prior to land disposal. If it is TCLP-toxic, it will have to be treated to remove that characteristic prior to land disposal.

Thirteen ground water monitoring wells, three piezometers, and MW #5 are located in the vicinity of the Weltronics building. In 1988, some of the wells installed in this area showed that contaminant concentrations decreased with depth. For example, well WS-5 contained 1,1-dichloroethane, trans-1,2-dichloroethene, trichloroethene and vinyl chloride totaling 308 μg/l in 1988. Well WD-5 installed at approximately the same location but with a screen depth 25 feet below that of WS-5 contained no chlorinated hydrocarbons above detection limits. In 1989, WS-5 concentrations had all dropped below detection limits, while well 211, which was screened approximately 10 feet deeper than WS-5 at approximately the same location contained 1,1-dichloroethane, vinyl chloride, 1,2-dichloroethene and 1,1,2-trichloroethane totaling 222 μg/l.

AMERICAN DRY CLEANERS AREA: The MDNR collected a composite sample of the upper 12 inches of the soil profile from immediately behind the American Dry Cleaners back door in 1982 which contained xylene at 18,000 ppb, tetrachloroethene at 200 ppb, and carbon tetrachloride at 40 ppb. A groundwater sample was collected during the RI from the monitoring well installed on the property by the MDNR in 1982. The analytical results of this water sample revealed: 9 ppb of trans 1,2-dichloroethene, 84 ppb of tetrachloroethene, and 2 and 1 parts per billion of trichloroethene and methylene chloride, respectively.

STANDARD OIL AREA: Unsaturated zone soil samples were collected from 4 borings in the Standard Oil Area. These revealed the presence of ethylbenzene at 26,000 ppb and xylenes up to 120,000 ppb in the unsaturated zone. Soil samples were also collected from two monitoring wells in this area. One sample from 47 feet depth contained trichloroethene and perchloroethene, the sum of which was 166 ppb. A deeper soil sample from a 75 foot depth contained no compounds of concern above detection limits.

Groundwater samples were collected from 4 monitoring wells in this area. Analysis results for these wells show trichloroethene up to 220 μg/l, trans-1,2-dichloroethene up to 85 μg/l, and vinyl chloride and perchloroethene were detected at concentrations below 5 μg/l.



POOR QUALITY ORIGINAL

FIGURE 2

TABLE 1
CLARE WATER SUPPLY SITE
MAXIMUM CONTAMINANT CONCENTRATIONS IN EACH SOURCE AREA

SOURCE AREA →	MITCHELL AREA		EX-CELL-O AREA		STANLEY OIL AREA		MDOT AREA	WELTRONICS AREA			DRY CLEANER AREA	STANDARD OIL AREA	
MEDIA →	Vadose Zone (μg/Kg)	Ground Water (μg/L)	Soil (μg/Kg)	Ground Water (μg/L)	Soil (μg/Kg)	Ground Water (μg/L)	Ground Water (μ/L)	Surface Soils (μg/Kg)	Deeper Soil (μg/Kg)	Ground Water (μg/L)	Ground Water (μg/L)	Soils (μg/Kg)	Ground Water (μg/L)
Acetone	5,000	400	14,000	1,200	90	290	70	60	270	37	5	7,000	13
2-butanone	30	NA	70	110	20	20	ND	20	ND	--	--	10	--
Benzene	20	NA	27	4	--	1,600	ND	--	--	--	--	--	--
*Toluene	2,000	7	36	10	10	42	310	57	30	1	ND	12	2
Total Xylenes	5,000	14	31,000	1,200	3,600	1,000	4,400	--	--	2	ND	120,000	2
Chloroethane	340	NA	--	--	--	--	--	--	--	--	--	--	--
1,1-dichloroethane	3,000	300	--	--	--	--	--	--	--	34	--	--	1
trans 1,2-dichloroethene	350,000	1,100	48	5,000	19	130	3	--	ND	120	9	--	88
Methylene Chloride	6,000	1,400	--	15	20	7	4	--	12	4	1	41	3
Trichloroethene	1,100,000	4,600	37,000	20,000	9	90	7	130	18	150	2	46	220
Tetrachloroethene	40,000	NA	--	--	--	--	--	--	ND	--	84	120	--
1,1,1-trichloroethane	510,000	1,400	--	--	--	--	--	--	ND	1	--	--	--
1,2-dichloroethane	19	--	14	--	9	--	--	--	ND	--	--	--	--
Napthalene	--	--	--	--	7,000	--	--	--	--	--	--	1,200	--
1,1,2-trichloroethane	56	ND	14	--	7	--	--	--	ND	71	--	--	--
Ethylbenzene	--	2	3,800	130	--	170	460	--	--	2	--	26,000	--
bis(ethylhexyl)phthalate	--	--	--	--	--	--	--	110,000	--	--	--	--	--
Total TICs	69,600	6	58,100	5,270	301,000	2,140	1,200	106,000	ND	ND	6	118,900	17
Vinyl Chloride	--	ND	--	25	--	32	ND	--	--	6	ND	--	3
Phenanthrene	--	--	--	--	--	--	--	--	--	--	--	900	--
Styrene	13	--	15	--	--	--	--	12	6	--	--	12	--
*Carbon Disulfide	53	--	120	--	110	8	ND	55	48	--	--	160	--

*Also present in lab blanks, thought to be lab contaminants

SUMMARY OF SITE RISKS

During the RI/FS, U.S. EPA and MDNR calculated the risks that the site would pose to human health and the environment if no remedial actions were taken. This process is called a baseline Risk Assessment (RA). The RA involves assessing the toxicity, or degree of hazard, posed by substances related to the site, and describing the routes by which these substances could come into contact with humans and the environment. Separate calculations are made for those substances that can cause cancer (carcinogenic) and for those that can cause non-carcinogenic health effects. The risks to human health are quantified by using Cancer Potency Factors for carcinogenic contaminants and Reference Doses for noncarcinogenic contaminants.

Cancer potency factors (CPFs) have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects upon humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

The National Oil and Hazardous Substances Contingency Plan (NCP) established acceptable levels of risk for Superfund sites ranging from 1 in 10,000 to 1 in 1 million excess cancer cases. This translates to a risk range of between $1x10^{-4}$ and $1x10^{-6}$. The NCP requires that the RA consider exposure scenarios both for current land use and for a conservative reasonable future use.

MEDIA AND CONTAMINANTS OF CONCERN

The media and contaminants of concern at the Clare site are listed in Table 2.

TABLE 2
1988-1991 CONTAMINANT CONCENTRATION RANGES
CLARE WATER SUPPLY RI/FS
CLARE, MICHIGAN

CHEMICAL	SOILS (µg/Kg)	SLUDGE (µg/Kg)	GROUND WATER (µg/L)	WELL WATER (µg/L)	SURFACE WATER (µg/L)	SEDIMENTS (µg/Kg)
Benzene	15-27	ND	1-1,800	2-4	ND	ND
1,1-dichloroethane	16-1,100	ND	1-300	1-1.5	3	14-3,000
Trans-1,2-dichloroethene	5-1,800	13,000-350,000	3-5,000	1-35	6-18	30-120,000
Cis-1,2-dichloroethene	ND	ND	1-37	1-36.9	ND	ND
Ethylbenzene	70-26,000	ND	1-460	ND	ND	ND
Methylene Chloride	5-1,000	140-1,200	1-1,400	2-3	1	7-6,000
Tetrachloroethene	7-120	1,500-40,000	3-84	ND	ND	67-6,900
1,1,2-trichloroethane	7-56	ND	1-71	ND	ND	ND
Trichloroethene	6-150,000	2,700-1,100,000	1-20,000	4-21	5	430-24,000
Toluene	6-79	ND	1-310	ND	ND	8-2,000
Vinyl Chloride	ND	ND	2-32	1-2	2	ND
Xylenes(Total)	5-120,000	ND	1-4,400	ND	ND	10-2,000
1,2-dichloroethane	6-19	ND	ND	ND	ND	ND
1,1,1-trichloroethane	9-21,000	160-510,000	1-1,400	ND	5	ND
Styrene	5-15	ND	ND	ND	ND	ND

ND -- Not Detected

EXPOSURE SCENARIOS

Persons who utilize municipal well water from the Clare Water Supply wellfield are identified as the population at risk in the excerpts from the Baseline Risk Assessment (Table 3) prepared by the PRPs. This particular Risk Assessment was completed prior to the current policy which requires all Risk Assessments to be performed by U.S. EPA. The primary routes of exposure to contaminants in groundwater are ingestion, inhalation of volatiles and dermal absorption. Benzene, Tetrachloroethene, Trichloroethene, methylene chloride, 1,1,2-trichloroethane, and vinyl chloride are probable or actual human carcinogens that are present in the groundwater contamination plume.

The carcinogenic and noncarcinogenic risks listed in Table 3 below were calculated by the PRPs using the average concentration of contaminants for each of the 6 exposure scenarios examined at the Clare Site:

TABLE 3
CARCINOGENIC AND NONCARCINOGENIC RISK CHARACTERIZATION

	EXPOSURE SCENARIO	MAXIMUM CANCER RISK	MAXIMUM HAZARD INDEX
1	Ingestion of VOCs through the municipal water supply for all residents of Clare;	ADULT: 1×10^{-4} CHILD: 5×10^{-5}	ADULT: 0.1 CHILD: 0.04
2	Dermal absorption of VOCs from showering to all residents of Clare;	ADULT: 8×10^{-7} CHILD: 2×10^{-6}	ADULT 0.001 CHILD 0.001
3	Dermal absorption of VOCs from children playing in contaminated surface water;	CHILD: 3×10^{-7}	0.00004
4	Inhalation from showering to all residents of Clare;	ADULT: 1×10^{-4} CHILD: 8×10^{-5}	ADULT 0.2 CHILD 0.4
5	Dermal absorption and incidental ingestion of VOCs from contaminated soils for workers or children in contaminated soil areas;	5×10^{-6}	0.003
6	Inhalation of volatile organic compounds (VOCs) to residents who live or work near water treatment plant.	ADULT: 1×10^{-7} CHILD: 4×10^{-7}	ADULT 0.0005 CHILD 0.002

The carcinogenic and non-carcinogenic risks above were calculated as if there were to be no action taken at the Clare Water Supply Site. Since the estimated non-carcinogenic risk is less than 1, no adverse non-carcinogenic effects would be expected. If the calculated non-carcinogenic risk were greater than 1, adverse non-carcinogenic health risks would be possible.

The carcinogenic risks calculated for scenarios 1, 2, 4 and 5 individually are within the U.S. EPA's acceptable risk range of $1x10^{-4}$ and $1x10^{-6}$. When the risks from these pathways are added to produce a sitewide risk the result is $2.1x10^{-4}$ which is just above the U.S. EPA's acceptable risk range. The operation of the air stripping towers since March 4, 1991, has temporarily reduced exposure of the public to unacceptable risk via scenarios 1, 2, and 4 since approximately 97% of the contaminants are being removed from the water supply prior to distribution. Consequently, the only current risks are from scenarios 3, 5, and 6 which estimate the risk from the contaminated soils, surface water, and the water treatment plant aeration system emissions and these risks fall within the acceptable risk range.

SOURCES OF UNCERTAINTY IN RISK ASSESSMENT

While the level of increased risk calculated for these scenarios in total is only slightly over the U.S. EPA's acceptable risk range, there are several factors explained below which were not considered in the PRPs' risk assessment that impact the risks calculated by the PRPs:

1) The PRPs used the average concentration of contaminants in groundwater to calculate the risks. The new Risk Assessment Guidelines state that in order to calculate the Reasonable Maximum Exposure (RME), the upper bound of the 95% confidence interval on the data is to be used rather than the average value. This raises the level of risk under each of the exposure scenarios. For example, the risk calculated by the PRPs for an adult drinking municipal water was listed as 1×10^{-4}. Using the upper bound of the 95% confidence interval and calculating the RME for the same scenario results in a risk of 7.9×10^{-4}.

2) Movement of the plume of groundwater contamination is continuing towards the municipal supply wells. The PRPs' risk assessment evaluated exposures based upon the concentrations of contaminants in the municipal water supply that were present during the Remedial Investigation. The concentrations of VOCs such as Trichloroethene were on the order of 20 parts per billion (ppb) in the municipal water supply wells. The concentrations of TCE in the groundwater in the source areas are as high as 20,000 ppb, a thousand times greater than the water currently being pumped by the municipal wells.

As stated above, the air stripper is currently removing approximately 97% of the VOCs from the water supply. The levels of TCE in groundwater currently being pumped by the municipal wells is around 20 ppb. Removal of 97% of 20 ppb leaves 0.6 ppb which is below the Maximum Contaminant Level (MCL) and also below the detection limit of the laboratory. As the more highly contaminated portion of the plume moves toward the supply wells, the level of TCE entering the supply wells will increase. It is difficult to say exactly how much it will increase, but if the groundwater from the source areas were to be diluted 100 times by the time it reached the supply wells, it would still contain approximately 200 ppb of TCE. Removal of 97% of the TCE by the air strippers would then leave 6 ppb in the water which would exceed the MCL. Consequently, as the more contaminated portion of the plume reaches the supply wells, the current air stripping treatment may not maintain the quality of the drinking water supply.

3) As the more highly contaminated groundwater in the plume reaches the municipal supply wells, the level of VOCs emitted to the atmosphere will increase. The air stripper installed during the 1st operable unit is currently removing approximately 97% of these contaminants from the drinking water and transferring them to the atmosphere. While the levels emitted to the atmosphere do not currently pose an unacceptable health risk, they will increase through time as the more highly contaminated portions of the plume move towards the supply wells.

4) Natural degradation of TCE continues to produce higher levels of the more toxic daughter product vinyl chloride in the groundwater and also in the air emissions from the air stripper.

5) Although the level of risk from dermal contact with and incidental ingestion of contaminated soils falls within the acceptable risk range of 10^{-4} to 10^{-6}, the contaminated soils contain the source of the contamination at the Clare Site. Continued leaching of contaminants from the soils into the groundwater will sustain the high levels of VOCs in groundwater. This will limit the effectiveness of any measures taken to address contaminated groundwater. The contaminated groundwater poses a significant health threat to an individual with a private water well or should the air strippers be taken off line for any reason (7.9×10^{-4} increased cancer risk corresponds to a Reasonable Maximum Exposure for ingestion of groundwater) or when more contaminated portions of the plume move into the water supply (1.04×10^{-2} increased cancer risk corresponds to an acute exposure scenario for ingestion of drinking water).

Actual or threatened releases of hazardous substances from this site, if not addressed by the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

REMEDIAL ACTION OBJECTIVES

The purpose of the remedy selection process is to implement remedies that eliminate, reduce, or control risks to human health and the environment. Remedial actions are to be implemented as soon as site data and information make it possible to do so. The National Contingency Plan at Section 300.430(a)(F) requires U.S. EPA to return usable groundwaters to their beneficial uses wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site. When restoration of groundwater to beneficial uses is not practicable, U.S. EPA expects to prevent further migration of the plume, prevent exposure to the contaminated groundwater, and to evaluate further risk reduction.

Consequently, U.S. EPA's goal at the Clare Water Supply site is to return the groundwater to its beneficial use within a timeframe that is reasonable. The aquifer which serves the Clare Water Supply is a current source of drinking water for the population of Clare. As such it falls into the category of a Class I aquifer if it is irreplaceable or a Class IIA aquifer if it is replaceable. For Class I and IIA aquifers, EPA's preference is for rapid restoration (within 1 to 5 years). The minimum restoration timeframe however, is determined by the hydrogeological conditions, the specific contaminants at the site, and the size of the contaminant plume.

For Class I and II groundwaters, the preliminary remediation goals are generally set at Maximum Contaminant Levels (MCLs), and non-zero Maximum Contaminant Level Goals (MCLGs) where relevant and appropriate, promulgated under the Safe Drinking Water Act or more stringent state standards. Pursuant to the SDWA, contaminant-specific levels or MCLs have been promulgated and are periodically revised which represent the maximum permissible level of a contaminant in water which is delivered to any user of a public water system. The MCLs for the contaminants of concern at the Clare Site are shown in Table 4.

The State of Michigan has also set cleanup levels for groundwater under Act 307. The substantive provisions of Parts 6 and 7 of the Michigan Act 307 Rules are considered ARARs for the remedial action to be undertaken at the Clare Water Supply Site. These Rules provide, inter alia, that remedial actions shall be protective of public health, safety, and welfare and the environment and natural resources. The Act 307 Type B cleanup levels for groundwater and soil are also shown in Table 4.

The U.S. EPA has determined that the cleanup levels in Table 4 derived under Michigan's Act 307 for groundwater and soils will also be protective of human health and the environment by reducing the current and potential future risk to within or below the U.S. EPA's acceptable risk range. The Type B cleanup levels for the 7 carcinogens listed in Table 4 (denoted with a ** by the name of the compound) correspond to a 1×10^{-6} level of risk for each individual chemical. Setting the cleanup levels to the Type B Cleanup Level for each individual compound, achieves an aggregate risk level for carcinogens of 7×10^{-6}. For comparison, the concentration in water which equals a 1×10^{-4} level of risk is also shown in Table 4 for the 6 carcinogens at the Clare Site. Also, the Oral Reference Dose, or estimate of a daily exposure to the human population that is likely to be without appreciable risk of deleterious non-carcinogenic effects over a lifetime is also shown in Table 4 for comparison.

TABLE 4 CLEANUP ACTION LEVEL (in ppb)				
CONTAMINANT	Act 307 Type B Groundwater	Act 307 Type B Soils	MCL	Concentration that produces a 10^{-4} cancer risk in drinking water
Benzene**	1	20	5	100
Vinyl Chloride**	*0.02	*0.4	2	1.5
Trichloroethene**	3	60	5	300
Tetrachloroethene**	*0.7	14	5	70
Methylene Chloride**	5	100	5	500
Trans 1,2-Dichloroethene	100	2,000	100	--
Cis 1,2-Dichloroethene	70	1,400	70	--
Total Xylenes	300	6,000	10000	--
Toluene	800	20,000	1000	--
Ethylbenzene	70	1,000	700	--
1,1-Dichloroethane	700	14,000	--	--
1,2-Dichloroethane**	*0.4	*8	5	40
1,1,2-Trichloroethane**	*0.6	12	5	60
1,1,1-Trichloroethane	200	4,000	200	--
Styrene	1	20	100	--

* The MDNR acceptable Method Detection Limit for all of these contaminants is 1 μg/L in water, and 10 μg/Kg in soil. The cleanup levels with an asterisk in the table are lower than the currently acceptable MDL so the cleanup level that will be enforced for this action will be the MDL for the asterisked contaminants.

** Classified as actual or possible human carcinogen

The areas of soil contamination which exceed cleanup levels for soil are depicted in Figures 4, 5, and 6. The general area encompassed by groundwater which exceeds the cleanup levels for groundwater is shown in Figure 7.

Cleanup Levels Where Groundwater Discharges to Surface Water

The potential exists for groundwater to naturally discharge into the US 10 Drainage Ditch. In the Proposed Plan, discharge limitations were proposed for the four compounds listed in Table 5 below. These discharge limitations were calculated in accordance with Rule 323.1057 of the Water Resources Commission Act (1929 PA 245, as amended). These limitations are more stringent than the Michigan Act 307 Type B cleanup criteria given in table 4. These limitations are to be applied at the point where groundwater naturally discharges to surface water. Michigan Administrative Code (MAC) Rule 299.5713 requires that these values not be exceeded at a point where groundwater naturally discharges to surface water. Demonstration of compliance with this rule may be made by monitoring at the groundwater-surface water interface, or by predictive modeling.

It is not necessary that the Table 5 values be achieved throughout the aquifer; however, a remedial action plan which proposes to meet the Table 5 values throughout the aquifer in lieu of monitoring at the interface is an acceptable substitute.

TABLE 5
RULE 57 DISCHARGE LIMITATIONS THAT ARE MORE STRINGENT THAN ACT 307 TYPE B CLEANUP LEVELS

COMPOUND	GROUNDWATER DISCHARGE TO SURFACE WATER (μg/L)
Total Xylenes	60
Toluene	100
Ethylbenzene	30
1,1,1-trichloroethane	100

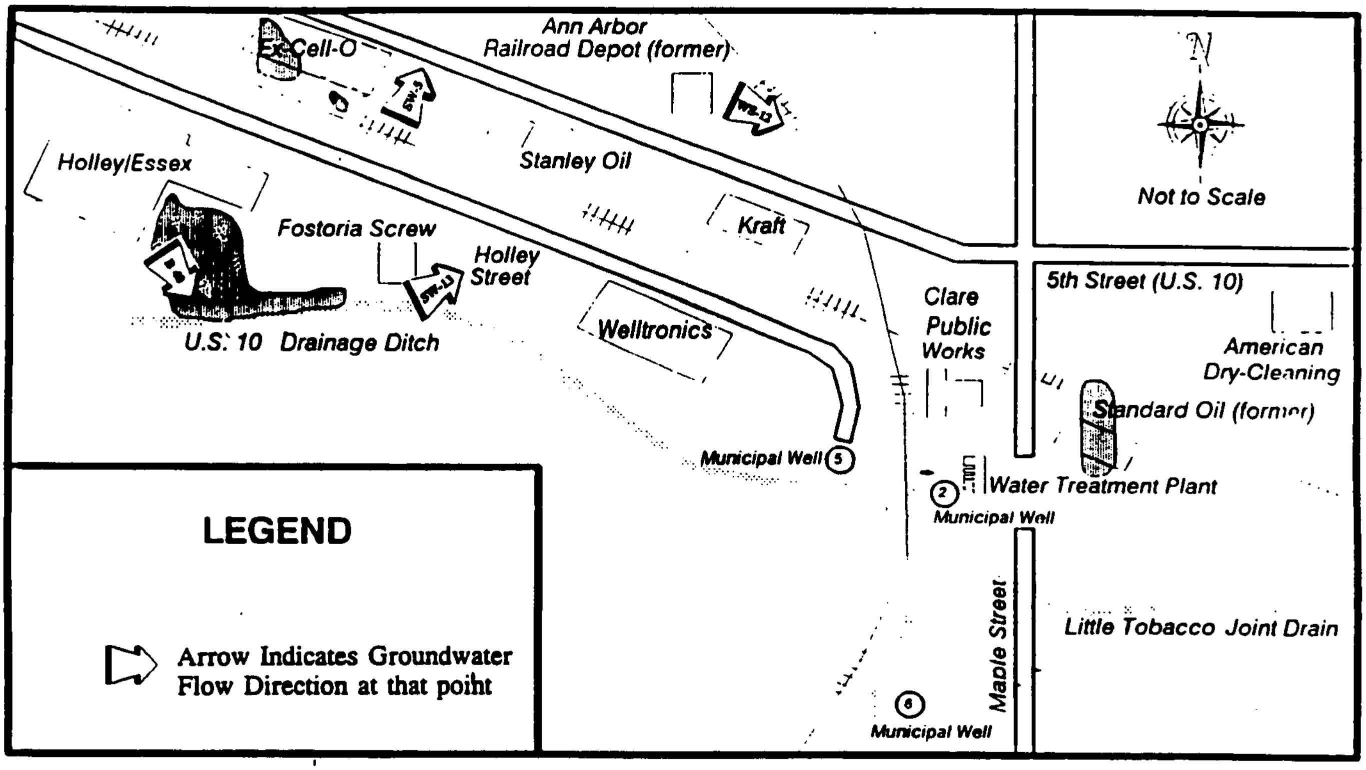
The analytical data in the RI revealed that there were 8 occurrences at the Clare Site where the groundwater exceeds the Table 5 value. These are listed in Table 6 below:

TABLE 6 OCCURRENCES OF CONTAMINANT LEVELS IN EXCESS OF RULE 57 SURFACE WATER CRITERIA

Location	Depth	Compound	Concentration in μg/l
B40	60'	1,1,1-trichloroethane	1,400
SW-5	3-6'	Ethylbenzene	110
SW-5	3-6'	Total Xylenes	1,200
SW-13	3.33-6.33'	Ethylbenzene	170
SW-13	3.33-6.33'	Total Xylenes	1,000
WS-12	22-27'	Ethylbenzene	460
WS-12	22-27'	Toluene	310
WS-12	22-27'	Total Xylenes	4,400

These 8 occurrences represent 4 separate locations. These 4 locations are shown on Figure 3. Superimposed on this figure is the average groundwater flow direction at each of the 4 locations. Figure 3 shows one location where groundwater contaminated at levels over the Table 5 values may impact surface water -- near the southeast corner of the Mitchell Building where the old lagoon area used to be located -- which is also the location where the highest levels of surface water contamination were detected in 1985.

Consequently, monitoring of the groundwater-surface water interface will be conducted during the remedial action at the locations where ground water discharges into surface water to demonstrate that this requirement is achieved. If this requirement is not being achieved, U.S. EPA, in consultation with MDNR, will evaluate the available information and develop an appropriate response action.



GROUNDWATER CONTAMINATION OVER RULE 57 SURFACE WATER CRITERIA

FIGURE 3

DESCRIPTION OF ALTERNATIVES

Seven (7) remedial action alternatives were carried through a detailed analysis in the Feasibility Study prepared for the Clare Water Supply Site by the PRPs. Alternative #1 is the no action alternative, which is required by the NCP. Alternative #2 utilized only institutional controls such as deed, use and access restrictions to control access to contaminated ground water and soils. Alternative #3 is the same as Alternative #2 except that contaminated soils are capped. Alternative #4A provides for in-situ vacuum extraction of organic contaminants from the soils. Alternative #4B provides for excavation and off-site incineration of contaminated soils. Alternatives #5A and #5B both address contaminated ground water only, but use air stripping/carbon adsorption or UV Photo-Chemical oxidation, respectively, to treat contaminated ground water which is collected from extraction wells, treated, and then either reinjected into the aquifer, discharged to surface water or to the Publicly Owned Treatment Works (POTW).

Detailed descriptions of each of these 7 remedial alternatives can be obtained in the FS. A brief description of the 7 alternatives follows on the next several pages. A summary of the components and costs associated with all 7 alternatives is presented here in Table 7.

MEDIA-SPECIFIC NATURE OF THE REMEDIAL ALTERNATIVES

Alternatives #4A and #4B are intended to address the soil media only. Alternatives #5A and #5B are intended to address the groundwater media only. The evaluation of the soil alternatives discusses how well each of these alternatives addresses soil contamination and the evaluation of the ground water alternatives discusses how well each of these alternatives address ground water contamination. This approach of evaluating media-specific alternatives individually requires that a combination of alternatives be selected to successfully meet the nine criteria. The combination of either Alternative #4A or #4B with one of the groundwater alternatives (#5A or #5B) could be protective of both soil and groundwater and meet ARARs for both media.

The U.S. EPA has decided to select a combination of alternatives using one of the alternatives that are designed to address soils (#4A) and one of the alternatives designed to address ground water (#5B) in concert with each other.

Since these 2 alternatives were developed as individual alternatives, they include components which are common to each other. The detailed components of the combination of Alternatives #4A and #5B are listed in the estimate of capital costs given in Table 8 of this Record of Decision. The FS only contains the detailed cost estimates for each individual alternative. The detailed cost estimate breakdown for the annual operation and maintenance of the combination of alternatives is given in Table 9 and the summation of annual O&M costs and calculation of Total Present Worth of the combination of alternatives is given in Table 10.

TABLE 7
REMEDIAL ACTION ALTERNATIVE COMPONENTS AND COSTS
CLARE WATER SUPPLY
CLARE, MICHIGAN

ALTERNATIVE DESCRIPTION		Capital Cost	Annual O&M	Present Worth
Alternative #1 **No Action**	o No Action o Monitor Groundwater	$ 246,000	172,000	$ 2,886,000
Alternative #2 **Institutional Action**	o Use, Deed, Access Restrictions o Drainage Ditch Diversion o Monitor Ground Water	$ 449,000	204,000	$ 3,562,000
Alternative #3 **Institutional Action with Containment**	o Use, Deed, Access Restrictions o Drainage Ditch Diversion o Cap contaminated soil areas o Monitor Ground Water	$ 1,356,000	197,000	$ 4,291,000
Alternative #4A **In-Situ Soil Vapor Extraction (SVE)**	o Use, Deed, Access Restrictions o Drainage Ditch Diversion o SVE with Carbon Adsorption o Shallow aquifer dewatering o Monitor Ground Water	$ 8,386,000	590,000	$ 20,467,000
Alternative #4B **Soil/Sediment Excavation, Off-Site Treatment, Off-Site Disposal**	o Use, Deed, Access Restrictions o Drainage Ditch Diversion o Excavate Contaminated Soil o Off-Site Treatment (Land Ban) o Disposal in Off-Site Landfills	$ 82,720,000	198,000	$ 85,760,000
Alternative #5A **Ground Water Extraction, Treatment by Air Stripping/ Carbon Adsorption and Shallow Well Reinjection**	o Ground Water Extraction o Air Stripping/Carbon o Liquid Carbon Adsorption o Shallow Well Reinjection o Monitor Ground Water	$ 2,054,000	1,405,000	$ 23,616,000
Alternative #5B **Ground Water Extraction, Treatment by UV Photochemical Oxidation and Shallow Well Reinjection**	o Ground Water Collection o Extraction Wells o UV Photochemical Oxidation o Catalytic Ozone Decomposition o Shallow Well Reinjection o Monitor Ground Water	$ 2,272,000	594,000	$ 11,374,000

ALTERNATIVE #1 NO ACTION

The No Action alternative is a baseline for comparison against all other alternatives. No remedial action would be taken at the site with regard to soil, sediment, groundwater or surface water contamination. No restrictions would be placed on access or future use of the site. Treatment of the city water supply would continue to be provided at the well heads before distribution to city residents as part of the Interim Remedial Action, a separate operable unit. Contaminant migration would be traced through a ground water and surface water monitoring program. Representative monitoring wells, consisting of both existing and new wells, would be used. The wells would be sampled once per quarter and water levels would be recorded.

Capital Cost:	$ 246,000
Average Annual O&M Cost:	172,000
Total Present Worth:	$ 2,886,000

ALTERNATIVE #2 INSTITUTIONAL ACTION WITH US 10 DRAINAGE DITCH DIVERSION

This alternative would include the implementation of institutional actions (deed, use, and access restrictions), ditch rerouting, and a monitoring program.

Deed restrictions would be placed on the properties where cleanup action levels are exceeded. These would limit further construction, excavation, and or well installation activities. Ground water use restrictions would be placed on the areas where ground water cleanup action levels are or would be exceeded. Treatment of the city water supply would continue to be provided at the well heads before distribution to city residents as part of the Interim Remedial Action, a separate operable unit.

In order to minimize transport of contaminated sediment off-site, the US 10 Drainage Ditch would be rerouted around the areas where soil/sediment cleanup objectives are exceeded. This would preferably be done during a time of low surface water flow to minimize the amount of water needing handling during construction.

The contaminated ditch area would be backfilled to grade with clean soil and inspected periodically. The areas containing contaminated soil and sediment above the cleanup objectives would be fenced. A 6-foot chain-link security fence topped with 3-strand barbed wire would be placed around each area. The fenced areas would be clearly posted with signs every 50 feet. The fencing and signs would be inspected periodically and maintained in good repair. Access to the fenced areas by workers would not be allowed unless adequate protective clothing/equipment were provided.

DURATION:	6 Months
Capital Cost:	$ 449,000
Annual O&M Cost:	204,000
Total Present Worth:	$ 3,562,000

ALTERNATIVE #3 INSTITUTIONAL ACTION AND CONTAINMENT WITH US 10 DRAINAGE DITCH DIVERSION

This alternative would include the implementation of institutional actions (deed, use, and access restrictions), ditch rerouting, construction of a multi-media cap, and a monitoring program.

This alternative is essentially the same as alternative #2, except that it provides for a multi-media cap to be constructed over each area where soil/sediment cleanup objectives are exceeded. The caps would function as moisture barriers to inhibit the infiltration of precipitation and would consist of a low-permeability barrier layer to prevent the vertical migration of water, a lateral drainage layer to direct water off of the low-permeability barrier, and a vegetative cover to limit erosion and provide frost protection.

The low-permeability layer of the cap would be designed as a composite layer consisting of two feet of soil and a synthetic membrane liner. The synthetic membrane would function as the primary infiltration barrier. The soil liner is included as a backup measure to increase liner integrity and must have a permeability of no more than 1×10^{-7} cm/sec. The surface of the low permeability layer would be sloped at approximately three percent to direct drainage toward the edge of the cover.

The drainage layer would be placed directly over the low-permeability barrier and consist of a one-foot thick sand/gravel layer. The drainage medium would be selected to provide a transmissivity of at least 5×10^{-4} m^2/sec. The drainage layer would be covered with a non-woven geotextile fabric in order to inhibit the migration of fine particles from the vegetative cover soil, limiting the potential for clogging.

A two foot thick vegetative cover would be placed over the drainage layer to provide erosion control and frost protection. The vegetative cover soils would be lightly compacted to prevent rutting from vehicles used for cap maintenance. The cover surface would be fertilized, seeded, and mulched to create a dense vegetative cover. The edge of the cap would be sloped to blend it into existing terrain. A 6-foot security fence topped with 3 strands of barbed-wire would be placed around each of the capped areas.

DURATION:	1 year
Capital Cost:	$ 1,356,000
Annual O&M Cost:	197,000
Total Present Worth:	$ 4,291,000

ALTERNATIVE #4A IN-SITU SOIL VAPOR EXTRACTION

This alternative would include the implementation of institutional actions (deed, use, and access restrictions), ditch rerouting, construction of an in-situ soil vapor extraction system, and a monitoring program. Soil and sediment with contaminant levels exceeding cleanup objectives would be treated in-situ by soil vapor extraction to remove volatile organic contaminants. A total of 54,800 cubic yards of soil, including that under buildings would be treated.

Within the treatment areas, ranks and rows of vacuum extraction and air inlet wells would be constructed to provide optimum control of air flow rates and pathways. The initial spacing of the wells has been estimated based on existing site and soil conditions for costing purposes. Final distances between wells would be determined through pilot study field data. The wells would be constructed with a 4-inch diameter Schedule 40 PVC pipe, screened with a 0.010-inch slot size. Sand pack would be installed around the well screen section and extended to approximately two feet above the top of the screen. The remainder of the well would be grouted to prevent leaks around the solid riser pipe.

If significant groundwater exists in the soil to be extracted, dewatering would be required. This would be accomplished by installing dewatering wells around the perimeter of each area. The extracted water would be treated by carbon adsorption before discharge.

The vapor extraction wells would be connected to the suction side of a blower. The vacuum at each of the inlet wells would be monitored. Operation of the system may include drawing fresh air from any of the inlet wells, balancing the vacuum at all inlet wells, or allowing for free air admittance.

A mist eliminator would be installed to remove moisture in the soil gases, preventing damage to the rotating lobes of the blower. The air would flow from the vapor extraction wells to an in-line mist eliminator located in the suction line of the blower. The entrained droplets would be removed in the mist eliminator and collected for proper disposal. The blowers would be a positive displacement-lobe type. Suction and discharge resonant-type sound suppressors would be provided to help reduce the normal noise of the air blower. The discharge from the blower would be routed to two granular activated carbon (GAC) filter units connected in series. The gas flow from the second GAC unit would be discharged to the atmosphere through a vent stack. After completion of the venting process or as the GAC units lose their effectiveness, the GAC units would be returned to the carbon supplier for carbon regeneration and thermal destruction of the collected VOCs.

DURATION:	10 years
Capital Cost:	$ 8,385,000
Annual O&M Cost:	590,000
Total Present Worth:	$ 20,467,000

ALTERNATIVE #4B EXCAVATION WITH OFF-SITE TREATMENT/DISPOSAL

In addition to deed and access restrictions, this alternative would provide for excavation of all accessible soil and sediment with contaminant levels exceeding the cleanup objectives. Due to the presence of a perched water table in discontinuous locations, dewatering of the perched water by wells installed around the perimeter of each area may be required before excavation. The extracted water would be treated by carbon adsorption before discharge. A water storage tank would temporarily hold the water to allow for the most efficient sizing of the carbon adsorption units. Unless excavation is conducted during a time when there is no flow in the US 10 drainage ditch, temporary rerouting of the flow in the ditch would be necessary during excavation. In order to allow excavation of the soils close to building, sheet piling would need to be installed. Approximately 15,600 cubic yards of soil and sediment with contaminant levels exceeding cleanup objectives are located under buildings. In order to protect the structural integrity of the buildings, this soil would remain in place.

Pretreatment of this excavated soil would be required if the contaminant concentrations in the soil exceeded treatment standards of the RCRA Land Disposal Restrictions (LDRs). The excavated soil would be loaded into lined trucks and transported as a hazardous waste to a RCRA-permitted incineration facility for treatment in a rotary kiln incinerator. After incineration, the treated waste would be transported to a landfill for disposal. Extensive fingerprint sampling of the waste would be required to allow the Treatment, Storage, or Disposal (TSD) facility to accept the excavated material. The excavated areas would be restored to grade with uncontaminated fill, regraded, and seeded or paved, as required.

DURATION:	1 year
Capital Cost:	$ 82,720,000
Annual O&M Cost:	198,000
Total Present Worth:	$ 85,760,000

ALTERNATIVE #5A GROUNDWATER EXTRACTION, AIR STRIPPING & CARBON ADSORPTION, AND SHALLOW WELL REINJECTION

This alternative would include the implementation of institutional actions (deed, use, and access restrictions; ditch rerouting, construction of ground water collection wells, an air stripping/carbon adsorption treatment system, and shallow reinjection wells; and a monitoring program. Contaminated ground water would be pumped from four (4) extraction wells, volatile organic contaminants would be removed using an air stripping column followed by GAC polishing, and the treated water would be reinjected into the aquifer through four injection wells. The number, location and pumping rates of the extraction wells may have to modified during the design phase.

DURATION:	over 100 years
Capital Cost:	$ 2,054,000
Annual O&M Cost:	1,405,000
Total Present Worth:	$ 23,616,000

ALTERNATIVE #5B GROUND WATER TREATMENT BY UV/OXIDATION

This alternative would include the implementation of institutional actions (deed, use, and access restrictions; ditch rerouting, construction of ground water collection wells, a UV/Chemical Oxidation treatment system and shallow injection wells, and a monitoring program. Contaminated ground water would be pumped from four (4) extraction wells, volatile organic contaminants would be removed using UV/Chemical oxidation and the treated water would be reinjected into the aquifer through four injection wells. The number, location and pumping rates of the extraction wells may have to be modified during the design phase.

DURATION:	over 100 years
Capital Cost:	$ 2,272,000
Annual O&M Cost:	594,000
Total Present Worth:	$ 11,374,000

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

In order to determine the most appropriate alternative for the Clare Water Supply site, the alternatives were evaluated against each other. Comparisons were based on the nine evaluation criteria outlined below.

1. **Overall Protection of Human Health and the Environment** addresses whether a remedy adequately protects human health and the environment and whether risks are properly eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. **Compliance with Applicable or Relevant and Appropriate Requirements** addresses whether a remedy meets all state and federal laws and requirements that apply to site conditions and cleanup options.

3. **Long-Term Effectiveness and Permanence** refers to the ability of a remedy to reliably protect human health and the environment over time once cleanup goals have been met.

4. **Reduction of Toxicity, Mobility, or Volume through Treatment** are three principal measures of the overall performance of an alternative. The 1986 Superfund Amendments and Reauthorization Act (SARA) emphasizes that whenever possible, the U.S. EPA should select a remedy that will permanently reduce the level of toxicity of the contaminants at the site, the spread of contaminants away from the site, and the volume, or amount, of contaminants at the site.

5. **Short-Term Effectiveness** refers to the likelihood of any adverse impacts to human health or the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

6. **Implementability** is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the remedy.

7. **Cost** includes capital, annual operation, and Total Present Worth costs of implementing a remedy.

8. **State Acceptance** indicates whether, based on its review of the initial data submissions by the PRPs and Proposed Plan, the State of Michigan (MDNR) concurs with, opposes, or has no comment on the alternative the U.S. EPA is selecting as the preferred response technology for the site.

9. **Community Acceptance** indicates whether the public concurs with, opposes, or has no comments on the remedy presented in the U.S. EPA's proposed plan.

The section below profiles the performance of the remedial alternatives against the nine criteria, noting how they compare to each other.

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

With the exception of Alternative #1, and assuming all deed, use and access restrictions are adequately enforced, all alternatives will be protective of public health and the environment. Alternatives 2 and 3 would be the least reliable since all of the contaminant mass remains in place and is not subject to any treatment. For Alternative #3, given the site conditions, contaminants under the cap would be exposed in the future if deed, use or access restrictions are not effective. Consequently, Alternatives 1, 2, and 3 would not significantly reduce risk since the contaminants would continue to leach into groundwater.

While the soil alternatives (#4A or #4B) or the groundwater alternatives (#5A or #5B) would not be as protective, the combination of either Alternatives #4A or #4B with one of the groundwater alternatives #5A or #5B would be protective of both soil and groundwater and meet ARARs. Alternatives #4A or #4B would address contaminated soils and eliminate much of the threat posed to human health by continued leaching of contaminants from the soil into groundwater. With the addition of an alternative to address the contaminated groundwater, either #5A or #5B, the increased lifetime cancer risk can ultimately be brought down to within or less than the U.S. EPA's acceptable risk range within a reasonable period of time. Operation of the air stripping system must continue to work in concert with the other remedial alternatives to prevent exposure to contaminants during the time it takes to achieve remedial action objectives.

COMPLIANCE WITH ARARs

The Maximum Contaminant Levels (MCLs) required of public water supplies by the Safe Drinking Water Act (SDWA) are being maintained currently through the use of the air stripping treatment system prior to distribution. Since the air stripper leaves 3 to 10% of the volatiles in the water after treatment, and monitoring data indicate that the plume is moving towards the municipal wells, eventually, the air strippers will not be able to maintain the MCLs when more highly contaminated portions of the plume reach the municipal wells.

The most conservative chemical-specific ARARs for groundwater are the Michigan Act 307 Type B standards. These could be met by either Alternative #5A or #5B. The chemical-specific ARARs for soil and sediment are also derived from the Act 307 standards and these could be met by Alternatives #4A or #4B. For Alternative #1, #2 or #3 to meet the chemical-specific ARARs for soils (the 307 standards) U.S. EPA, in consultation with MDNR, would have to determine that the Clare Water Supply Site meets the requirements for a Type C Cleanup. U.S. EPA has decided that the appropriate cleanup levels for groundwater are the Type B criteria as explained on page 16 of this ROD.

Some contaminants at this Site are RCRA listed wastes. Trichloroethylene (TCE) and tetrachloroethylene (PCE) are RCRA listed wastes F001 and F002. Because of this, the removal of the soil under Alternative #4B (and Alternative #4A, if soil returned to the surface from drilling or trenching operations were moved from the area of contamination) would trigger RCRA requirements, including treatment and disposal requirements provided in the Land Disposal Restrictions (LDRs). Under Alternative #4B, residues generated from incineration of the soil would be disposed of in an off-site landfill. Unless delisting of the waste is accomplished, the treated waste would have to be disposed of in a RCRA Subtitle C landfill. If the contaminated soil is not removed, as in Alternatives #1, #2, #3, #4A, #5A and #5B, the RCRA closure requirements are not applicable because the jurisdictional prerequisites for their applicability are not met. Also, in both Alternatives #4A and #5A, the carbon adsorption units will capture solvent constituents from the listed solvents, making the spent carbon hazardous waste. In addition to the listed waste, the spent carbon may also retain enough solvent to become characteristic. If the carbon is to be regenerated, it may be treated only in a unit in compliance with RCRA regulations for miscellaneous units, as set forth in 40 CFR Part 264 Supart X.

Emissions from the treatment system in Alternative #4A is required to meet the substantive provisions of Michigan's Act 348. U.S. EPA will require monitoring of off-gas emissions to ensure that Alternative #4A will achieve this requirement. It may be necessary to provide for the use of vapor phase carbon adsorption prior to off-gas emission to the atmosphere in order to meet these requirements.

Alternative #5B may generate ozone as its only byproduct. Clare County, Michigan, is an attainment area for the ozone National Ambient Air Quality Standard of 0.12 ppm. In Region 5, this standard has been applied as an ARAR for remediation work. Alternative #5B includes a pilot study that will verify the efficiency of the catalytic ozone decomposition unit in order to help ensure that the ozone standard will continue to be maintained.

The combined remedy chosen will meet chemical-specific ARARs for both groundwater and soils.

LONG-TERM EFFECTIVENESS AND PERMANENCE

Long-term residual risk is greatest for Alternatives 1, 2, and 3 since no treatment is being performed. If institutional controls (deed, use and access restrictions) are enforced and an adequate source of drinking water is available, the current residual risk should be negligible for all alternatives except Alternative #1. However, through time, as more highly contaminated groundwater moves toward the municipal wells, the levels of VOCs which are left in the municipal water supply and also emitted to the atmosphere by the existing air stripping towers may increase.

Alternatives #4A and #4B reduce residual risk from exposure to soil and sediment through treatment. In addition, residential, commercial, and industrial developments can be prevented by imposing deed restrictions. Access restrictions provided by fencing prevent direct contact. The potential for skin irritation from direct contact with contaminated sediment should be eliminated after completing the ditch rerouting and enforcement of access restrictions.

Alternatives #5A and #5B reduce residual risk from exposure to groundwater through treatment. In addition, ground water use restrictions and an adequate source of drinking water minimize the residual risk from ground water.

The reliability of all alternatives except Alternative #1 depends on the enforcement of institutional controls. Greater degrees of reliability are offered by the more treatment-intensive alternatives, since institutional controls are relied upon to a lesser degree. If institutional controls were to be weakened by future legal or regulatory changes or disregarded by future property owners, and the site developed, the risk to human health could be significant.

Consequently, the use of a combination of alternatives, #4A to address contaminated soils and #5B to address contaminated groundwater, could ultimately eliminate the need for long term enforcement of institutional controls and provide a sitewide remedy which is effective in the long term.

REDUCTION IN TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT

The only alternatives which utilize treatment are Alternatives #4A and #4B for soils and #5A and #5B for groundwater.

Alternative #4A would treat more soil than Alternative #4B since #4A is conducted in-situ and it can be performed on soils which are located under buildings. Alternative #4B, which involves excavation would not be able to treat the 15,000 cubic yards of contaminated soil which is located under buildings.

Alternative #5A provides for treatment of VOCs only after contaminated vapor carbon is removed from the system and regenerated off-site. Alternative #5B provides treatment at the site by emitting ozone as its only byproduct and then decomposing the ozone within the catalytic ozone decomposition unit. Consequently, Alternative #5B would produce no residues, sludges, or spent adsorbents. It essentially reduces the volume of contaminants to nothing as part of its process, whereas Alternative #5A would rely upon off-site regeneration to achieve volume reduction through treatment.

The combination of a soil and groundwater treatment alternative will work together in several different ways to achieve a higher reduction in toxicity, mobility and volume than one of the soil or groundwater alternatives by itself. For example, the Soil Vapor Extraction alternative could allow increased air flow through the air inlet wells into the subsurface. This would enhance any aerobic bacterial decomposition of VOCs that may be occurring. Additionally, the extraction of groundwater may lower the water table in the source areas slightly which would enhance the effectiveness of the soil vapor extraction system since it works better in soils which are not saturated.

SHORT-TERM EFFECTIVENESS

Actions under all alternatives would be performed such that there would be minimal risk to the community and to workers. This would mean that appropriate health and safety measures would be observed during the construction and operation phases of the alternatives.

Dust control technologies and erosion/runoff controls will mitigate environmental impacts caused by handling of the contaminated soil and sediment during Alternatives #4A, #4B, #5A and #5B. Careful monitoring of the vapor extraction system during the operation phase of Alternative #4A would mitigate impacts from possible emissions releases. Emission of volatiles resulting from the treatment of the groundwater in Alternatives 5A and 5B will be monitored and a contingency plan will be included with the design to mitigate impacts from possible emissions releases.

Completion of Alternatives #2, #3, and #4B would take the least time (from 6 months to 1 year), but would not by themselves achieve all remedial action objectives since they only address soils. Implementation of either of the groundwater alternatives, #5A or #5B, by themselves would take in excess of 100 years to achieve remedial action objectives since the contaminants in the soils would continue to leach into groundwater. It should be noted that a study entitled "Evaluation of Groundwater Extraction Remedies" found that continued leaching from source areas was one of several factors that limit the effectiveness of groundwater extraction systems. The remediation time frame should be significantly reduced by implementation of a soil treatment alternative (#4A or #4B) in combination with a groundwater alternative (#5A or #5B). The exact prediction of remediation time frame for the combination of soil and groundwater alternatives is difficult, based upon the available data, however, the U.S. EPA estimates the aquifer cleanup time with a combination alternative at approximately 30 years.

IMPLEMENTABILITY

The institutional controls employed by all alternatives except Alternative #1 may be difficult to enforce. Limited difficulties should be associated with the rerouting of the ditch (Alternatives #2, #3, #4A, #4B, #5A, and #5B) or the construction of a cap (Alternative #3). The installation of the soil vapor extraction system in Alternative #4A may be difficult inside existing structures due to existing concrete floors and installed equipment. If significant ground water exists in the soils to be vapor extracted, a dewatering system will be necessary and the operation of the vapor extraction wells would depend on the effectiveness of the dewatering system. All activities for all alternatives would need to be coordinated with concurrent manufacturing activities.

Soil vapor extraction, ground water air stripping with carbon adsorption, and ground water UV Photochemical oxidation are demonstrated technologies that have adequate equipment and specialists available. More than one vendor would be available to provide competitive bidding for each of these technologies. Adequate facilities exist for the regeneration of carbon (Alternatives 4A, 4B, and 5A) although they are some distance from the site. The availability of incinerators and landfills in the State of Michigan that can accept, treat, and dispose of the excavated contaminated soil and sediments generated by Alternative #4B is limited. It will likely be necessary to dispose of this waste out of state.

Due to long-term site monitoring activities, coordination among agencies, especially the USEPA, MDNR, and MDPH, will be required. Consultation with these agencies would also be involved to insure that the substantive environmental requirements are applied to and met by this action.

COST

The estimated capital costs (See Table 7) range from $246,000 for Alternative #1 to $82,720,000 for Alternative #4B. The estimated average annual operation and maintenance costs range from $172,000 for Alternative #1 to $1,405,000 for Alternative #5A. The estimated present worth ranges from $2,886,000 for Alternative #1 to $85,760,000 for Alternative #4B.

The No Action Alternative (Alternative #1) has the lowest present worth as costs only include those for continued contaminant monitoring, but would provide little protection of human health and the environment. Alternatives #2 and #3 have the next lowest present worth but rely heavily on institutional controls. The capital and present worth costs for Alternative #4B ($82,720,000 and $85,760,000, respectively) are prohibitive. Alternative #4A, the soil vapor extraction option, provides similar protectiveness at considerably lower present worth cost ($20,467,000), but would take a longer time to implement. Both ground water treatment Alternatives (Alternatives 5A and 5B) provide equal protection; however, the operation and maintenance cost, a continuing expense, is considerably lower (1/3) for the UV Photochemical oxidation treatment. Consequently, the alternatives which provide the most treatment for the least cost are Alternative #4A (Soil Vapor Extraction) and #5B (UV

Photochemical Oxidation).

The U.S. EPA has decided to combine components of both of these alternatives to form a combination alternative that will address both contaminated soils which are the source of the groundwater contamination and contaminated groundwater. The combined capital cost of these two alternatives is $4,461,686 with an average annual Operation & Maintenance Cost of $431,183. The Total Present Worth of the combined alternative is $11,754,246. This is only slightly more than the total present worth of the groundwater alternative alone and it results in the potential for completing the cleanup within 30 years as opposed to over 100 years if only groundwater extraction and treatment were performed.

STATE ACCEPTANCE

The State of Michigan agrees with the EPA's selected remedy at this Site.

COMMUNITY ACCEPTANCE

The community acceptance was evaluated based upon: the questions from the public during the public meeting; the one verbal comment given at the public meeting; and, the written comments submitted during the public comment period. Based upon the questions taken at the public meeting, the community reaction towards the proposed remedy was mixed, some for and some against. One written comment was against taking this action because the commenter felt that the money it would take to implement and operate the remedial action, approximately $11 million, could be better used to cure the people who became afflicted by cancer as a result of the contamination. The written comments received during the comment period followed this pattern: 1 supporting the U.S. EPA's selection, 1 against the U.S. EPA's selection, and 1 that wanted more information before they could determine whether the proposal was acceptable.

There appeared to be a consistent theme in the questions and comments received regarding a statement in the Proposed Plan regarding the potential for a third operable unit. The scope of the potential third operable unit is to address any new soil hot spots that are discovered in the next phase of the PRPs' investigation. The PRPs are planning to install new borings and monitoring wells in several other parts of the Site to determine if there are additional sources. The PRPs have already sent access agreements to numerous business owners seeking their consent to perform this work. This has had the effect of engendering fear on the part of these companies that they may at some point in time be asked to participate in the cleanup action. Consequently, some members of the public who represent business interests in Clare, are not in favor of undertaking the proposed remedy because of the potential cost involved. However, there were members of the public who expressed their support of the U.S. EPA's proposal during the question and answer session at the public meeting.

For more detailed responses to the public comments, refer to the attached Responsiveness Summary.

SELECTED REMEDY

The U.S. EPA's selected remedy is Alternative #4A (IN-SITU SOIL VAPOR EXTRACTION) for the contaminated soil areas (See Figures 4, 5, & 6) and Alternative #5B (EXTRACTION & TREATMENT USING UV PHOTOCHEMICAL OXIDATION) for the contaminated groundwater (See Figure 7).

This remedy is necessary to meet the U.S. EPA's objective of restoring the only source of groundwater for the population of Clare to its beneficial use as a drinking water supply within a reasonable timeframe. If contaminated soils, which serve as a source of contamination to the aquifer, are not addressed along with the groundwater, the soils will continue to leach contaminants into the groundwater and sustain the plume for over 100 years. Addressing the soils along with the groundwater could make it possible to cleanup the aquifer within approximately 30 years.

The combined alternative will include use, deed and/or access restrictions as necessary; diversion of the US10 Drainage Ditch around contaminated sediments while the remedial action is being conducted; Soil Vapor Extraction; ground water extraction and treatment using ultraviolet photochemical oxidation. There are several additional engineering features that may be added to the component of this remedial action that addresses contaminated soils based upon information to be obtained during pre-design activities. These enhancements may include: limited excavation of "hot spots" where soil vapor extraction may not be practicable; temporary capping of areas to be treated using soil vapor extraction to enhance the effectiveness of this process; or, the addition of nutrients or oxygen to enhance bacteriological degradation of VOCs. These modifications shall not be used as replacements of the selected soil remedy, only as necessary to enhance its effectiveness and efficiency.

Under Alternative 5B, groundwater shall be extracted until Federal Maximum Contaminant Levels (MCLs) or non-zero Maximum Contaminant Level Goals (MCLGs), promulgated under the Safe Drinking Water Act, and the groundwater cleanup standards derived under Michigan Act 307, Type B criteria are met in the groundwater contaminant plume. (See Table 4 for Groundwater Cleanup Standards.) The extracted groundwater shall be treated on site using the UV Photochemical Oxidation System and discharged to injection wells located upgradient from the site or discharged to the Tobacco River, in compliance with the substantive requirements of a NPDES discharge permit, as administered by the State under Part 21 of Michigan Act 245. The goal of this remedial action is to restore the groundwater to its beneficial use, which is, at this site, an actual drinking water source. Based on information obtained during the RI and on a careful analysis of the remedial alternatives, the U.S. EPA believes that the selected remedy will attain this goal. It may become apparent, during implementation or operation of the groundwater extraction system, that contaminant levels have ceased to decline and are remaining constant at levels higher than the Groundwater Cleanup Standards over some portion of the contaminant plume. In such a case, the system performance standards, the system design, and/or the remedy may be reevaluated. And, if such a reevaluation results in a determination that the Groundwater Cleanup Standards can not be achieved, alternate groundwater cleanup standards will be considered by U.S. EPA, in consultation with MDNR.

Based upon the calculations of aquifer restoration time contained in the administrative record, it is estimated that the Groundwater Cleanup Standards can be achieved in the groundwater within 30 years if the soil contamination is addressed. System performance monitoring will be performed on a regular basis. If warranted, the system may have to be modified in order to achieve the cleanup goals. The following are examples of what might be required as modifications to the system include, but are not limited to:

(a) Pumping may be discontinued at individual wells where Groundwater Cleanup Standards have been attained;

(b) Wells may be pumped on an alternate basis to eliminate stagnation points;

(c) "Pulse pumping" may be performed to allow the aquifer to equilibrate and allow adsorbed contaminants to partition into the groundwater for extraction; and

(d) Additional extraction wells may be installed to facilitate or accelerate cleanup of the contaminant plume.

(e) Air Sparging or Bioventing (See Administrative Record Update #5 for more information on this area of research) may be incorporated into the groundwater extraction system to enhance the biodegradation and removal of volatiles. This technique has been used recently at a growing number of contaminated groundwater sites with dramatic results.

Groundwater will be monitored periodically at any well where the Cleanup Standards appear to have been achieved, and pumping has ceased, to ensure that Groundwater Cleanup Standards continue to be met. A fence shall be maintained around the soil vapor extraction system and the groundwater treatment system to prevent access to the site.

The costs of implementing the combination of alternatives #4A and 5B is not the same as the sum of the costs of the individual alternatives since they include some common cost elements such as: Site preparation, diversion of the US10 drainage ditch, access restrictions, ground water monitoring, labor, site inspections, etc. Also, some elements of the Soil Vapor Extraction alternative that were included in the PRPs' cost estimates in the FS were unnecessary and have been removed from the cost estimate for the combined alternative. Consequently, the costs of the combination of alternatives are presented in this Record of Decision (See Tables 8, 9, and 10) and were also presented in the Proposed Plan. The **Capital Cost** is estimated at $4,461,686. The **average annual Operation & Maintenance Cost** is estimated at $431,183. The **Total Present Worth** over 30 years using a 5% discount rate is $11,754,247.

Based on current information, this combined remedy appears to provide the best balance of trade-offs among the alternatives with respect to the nine criteria that U.S. EPA uses to evaluate alternatives.

FIGURE 4

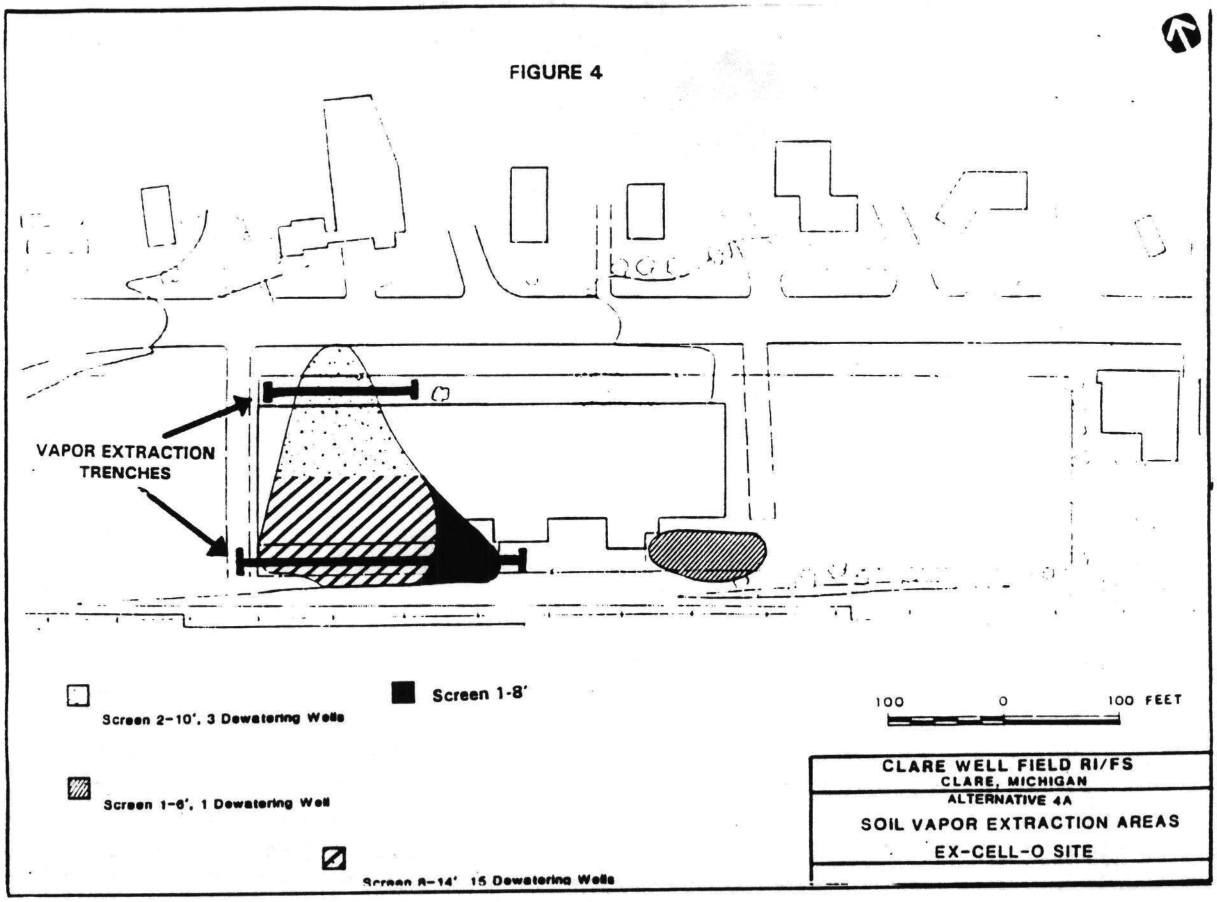
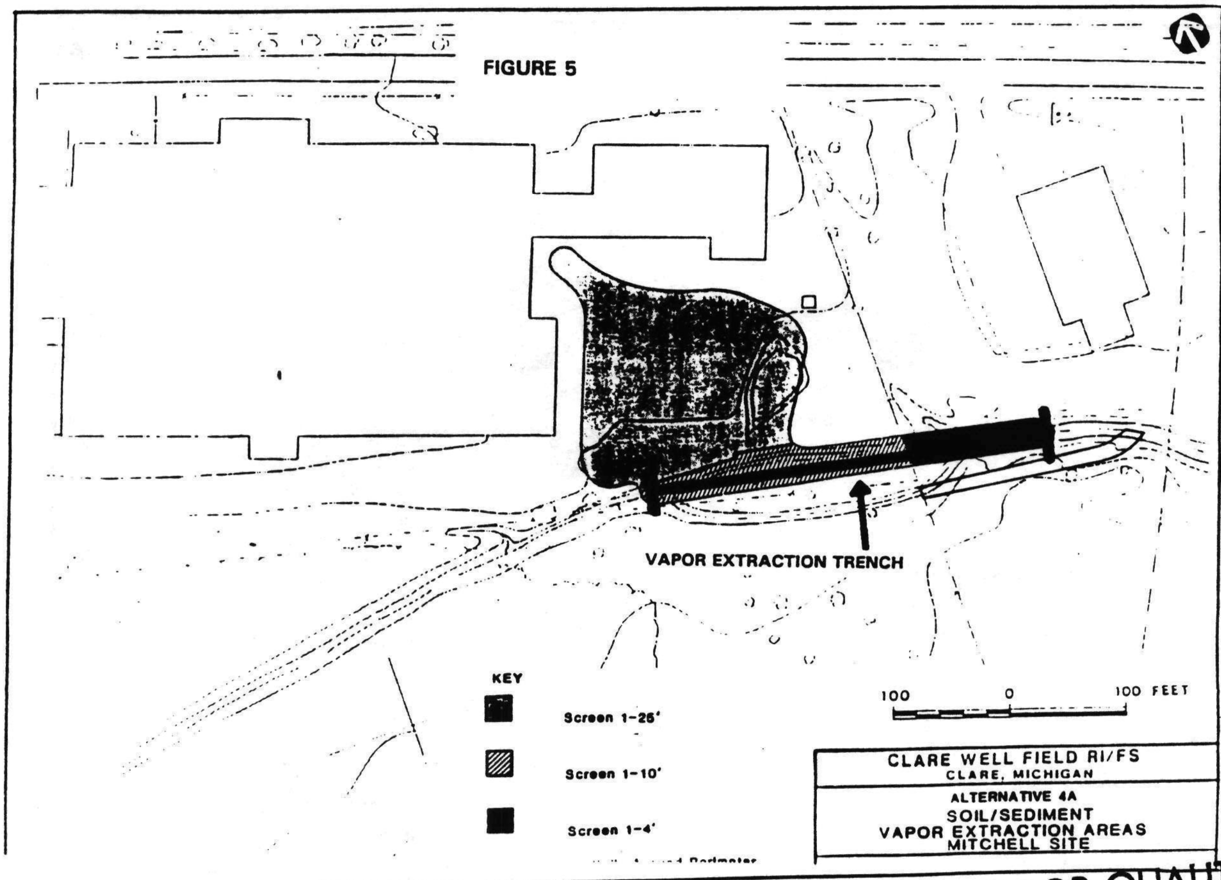
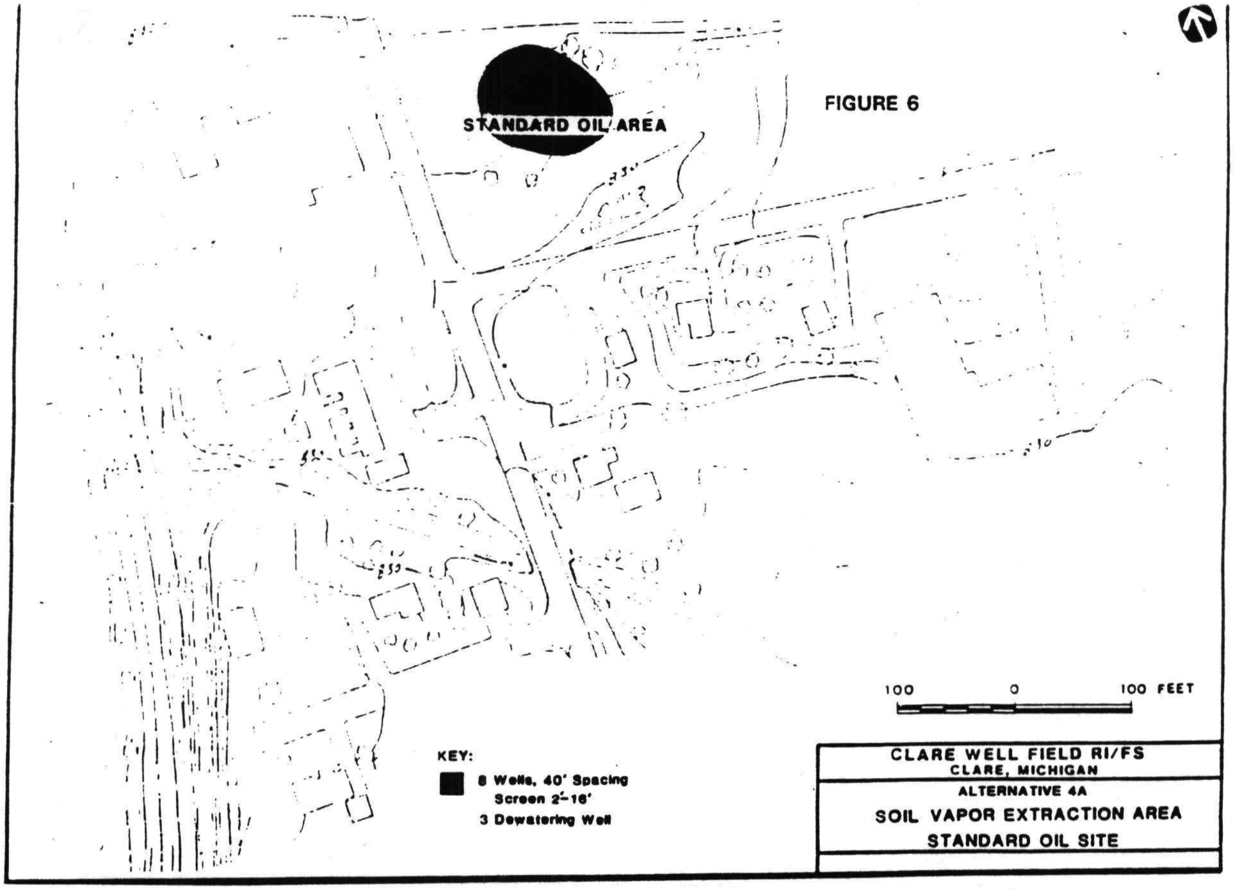
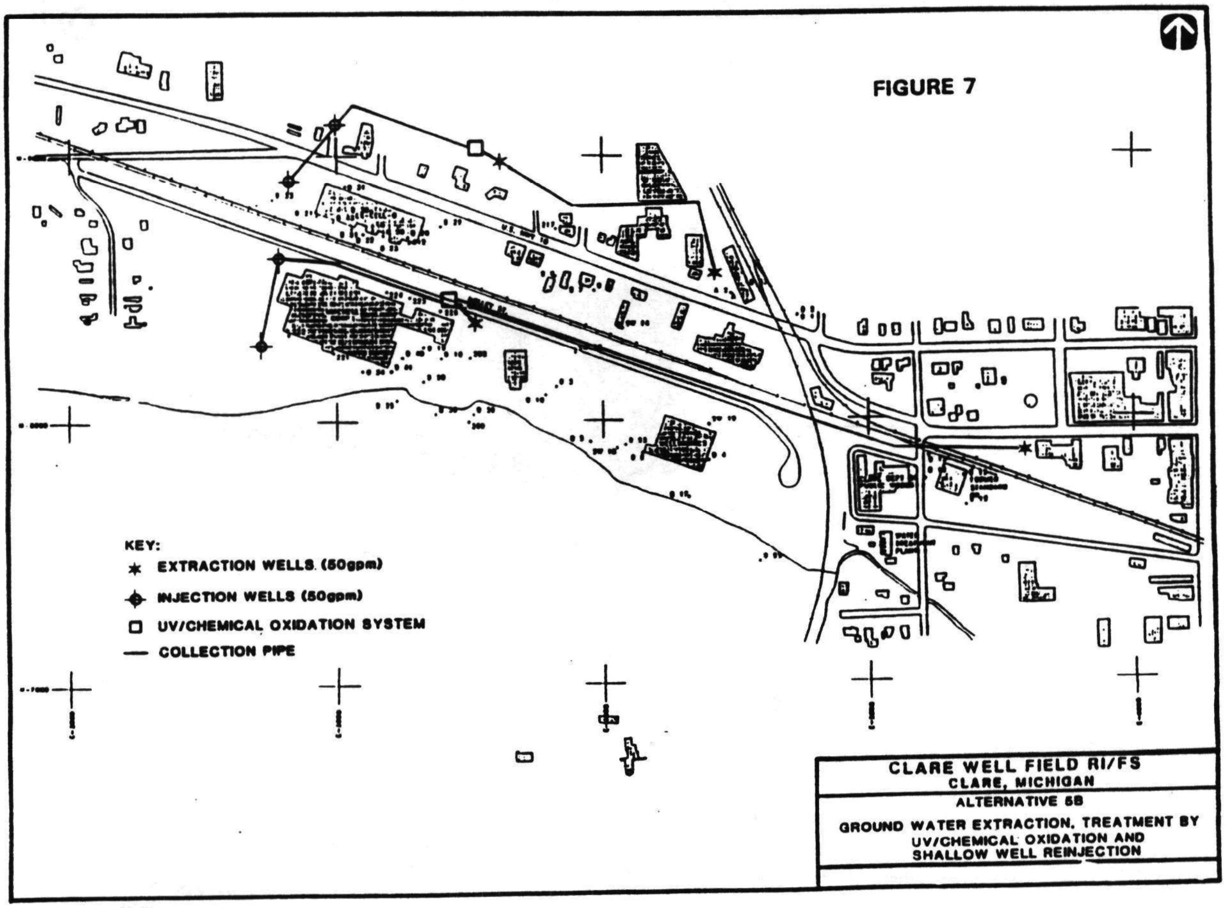


FIGURE 5



POOR QUALITY ORIGINAL





POOR QUALITY ORIGINAL

TABLE 8 - CAPITAL COST FOR COMBINATION OF ALTERNATIVES 4A & 5B

CAPITAL COSTS	Quantity	Unit	Unit Price	Total Cost
1. Site Preparation				
Divert US10 Drainage Ditch	1	ls	$15,000.00	$15,000.00
2. SVE Soil Treatment Systems				
Wells	844	ft	$60.00	$50,640.00
Asphalt Cutting / Concrete Removal	2500	lf	$2.00	$5,000.00
Asphalt Removal	11000	sf	$0.45	$4,950.00
Asphalt/Concrete handling/disposal	285	cy	$40.00	$11,400.00
Asphalt Replacement	11000	sf	$3.90	$42,900.00
Concrete Cutting	1400	lf	$6.00	$8,400.00
Concrete Replacement	2080	sf	$9.00	$18,720.00
Trenching	720	lf	$8.00	$5,760.00
Perforated Pipe	720	lf	$5.00	$3,600.00
Well heads	39	ea	$400.00	$15,600.00
Extraction piping	2650	lf	$16.40	$43,460.00
Mechanical equipment	1	ls	$106,000.00	$106,000.00
Buildings	1500	sf	$40.00	$60,000.00
Piping subfloor	15000	sf	$20.00	$300,000.00
1800 # Carbon units	48	ea	$8,000.00	$240,000.00
Analytical testing for carbon	19	ls	$1,500.00	$28,500.00
Dewatering wells	18	ea	$1,000.00	$18,000.00
Carbon adsorption dewatering	8	ea	$10,000.00	$80,000.00
Electrical	1	ls	$60,000.00	$60,000.00
Pilot Study	1	ls	$75,000.00	$75,000.00
3. Access Restrictions				
Fencing	2450	lf	$14.00	$34,300.00
Gate	5	ea	$700.00	$3,500.00
Signs	49	ea	$50.00	$2,450.00
Deed Restrictions				
4. Gr. Water Wells & Injection				
Asphalt Cutting	3735	lf	$2.00	$7,470.00
Asphalt Removal	5602	sf	$0.45	$2,520.00
Asphalt handling/disposal	104	cy	$40.00	$4,160.00
Asphalt Replacement	5602	sf	$3.90	$21,847.80
Electrical installation	8	ls	$10,000.00	$80,000.00
Wells	560	ft	$200.00	$112,000.00
Extraction well piping	3147	ft	$37.00	$116,439.00
Injection well piping	2830	ft	$37.00	$104,710.00
Well heads	8	ea	$400.00	$3,200.00
Well development	8	ea	$2,000.00	$16,000.00
Well pumps	8	ea	$1,500.00	$12,000.00
Instrumentation	1	ls	$30,000.00	$30,000.00
Railroad Track Crossings	4	ea	$15,000.00	$60,000.00
5. Ground Water Treatment				
100 gpm UV/Oxidation Unit	2	ls	$267,800.00	$535,600.00
6. Ground Water Monitoring				
Mobilization/Demobilization	1	ls	$1,000.00	$1,000.00
Drilling	874	lf	$100.00	$87,400.00
Well Development/screening	28	ea	$1,800.00	$50,400.00
Bladder pumps	6	ea	$600.00	$3,600.00
7. Contingencies				
General	25%			$656,382.00
Health & Safety Protection	10%			$262,552.77
8. Other				
Permitting				$75,000.00
Administration	5%			$177,223.12
9. Engineering				
Design Services				$300,000.00
Construction Services				$365,000.00
TOTAL CAPITAL COSTS				**$ 4,461,685.51**

TABLE 9
OPERATION & MAINTENAN[illegible] OSTS
COMBINATION OF ALTERNATI[illegible] 4A + 5B
CLARE WATER SUPPLY SITE

Operation & Maintenance	Quantity	Unit	Unit Price	Total Cost	Years
Annual Operation SVE System					
a. Operation	1	ls	$205,000.00	$205,000.00	
b. Labor	1000	hr	$65.00	$65,000.00	
c. Project Management	250	hr	$100.00	$25,000.00	
d. Carbon dewatering	8	ea	$10,000.00	$80,000.00	
SUBTOTAL				**$375,000.00**	
Annual Operation GW System					
a. Electricity & Chemicals	365	day	$150.00	$54,750.00	
b. System Operation	1000	hrs	$45.00	$45,000.00	
c. System Maintenance	8	days	$400.00	$3,200.00	
d. UV Lamp Replacement	200	lamps	$60.00	$12,000.00	
SUBTOTAL				**$114,950.00**	
Annual maintenance					
a. Mowing	2	ac	$700.00	$1,400.00	
b. Erosion Repair	2	ac	$250.00	$500.00	
c. Fencing Repair	1	lf	$1,000.00	$1,000.00	
SUBTOTAL				**$2,900.00**	
Variable replacement					
a. Refurbish wells	1	ls	$19,000.00	$19,000.00	10,20,30
b. Replace Bladder pumps	6	ea	$600.00	$3,600.00	5,10,15,20,25,30
c. Replace 4 ext. pumps	4	ea	$1,500.00	$6,000.00	5,10,15,20,25,30
d. Replace 4 ext. wells	4	ea	$800.00	$3,200.00	20
e. Replace 4 inj. pumps	4	ea	$1,500.00	$6,000.00	5,10,15,20,25,30
f. Replace 4 inj. wells	4	ea	$800.00	$3,200.00	20
g. Confirmatory Sampling	1	ls	$48,000.00	$48,000.00	5
SUBTOTAL				**$89,000.00**	
Annual Monitoring					
a. Sampling/shipping	4	ea	$2,000.00	$8,000.00	
b. Monitoring wells	90	ea	$1,000.00	$90,000.00	
c. comprehensive sampling	30	ea	$1,500.00	$45,000.00	
d. Surface Water Sampling	5	ea	$1,500.00	$7,500.00	
e. Extraction well samples	36	ea	$1,000.00	$36,000.00	
f. Injection well samples	36	ea	$1,500.00	$54,000.00	
g. Annual Report	1	ea	$3,500.00	$3,500.00	
SUBTOTAL				**$244,000.00**	
AVERAGE ANNUAL O&M:					**$ 431,183**

TABLE 10

CALCULATION OF PRESENT WORTH COSTS
COMBINATION OF ALTERNATIVES 4A + 5B

YEAR	ANNUAL O&M COST	DISCOUNT RATE 5%	PRESENT WORTH
1	736850	0.9524	$701,776
2	736850	0.9070	$668,323
3	736850	0.8638	$636,491
4	736850	0.8227	$606,206
5	800450	0.7835	$627,153
6	361850	0.7462	$270,012
7	361850	0.7107	$257,167
8	361850	0.6768	$244,900
9	361850	0.6446	$233,249
10	396450	0.6139	$243,381
11	361850	0.5847	$211,574
12	361850	0.5568	$201,478
13	361850	0.5303	$191,889
14	361850	0.5051	$182,770
15	377450	0.4810	$181,553
16	361850	0.4581	$165,763
17	361850	0.4363	$157,875
18	361850	0.4155	$150,349
19	361850	0.3957	$143,184
20	402850	0.3769	$151,834
21	361850	0.3589	$129,868
22	361850	0.3418	$123,680
23	361850	0.3256	$117,818
24	361850	0.3101	$112,210
25	377450	0.2953	$111,461
26	361850	0.2812	$101,752
27	361850	0.2678	$96,903
28	361850	0.2551	$92,308
29	361850	0.2429	$87,893
30	396450	0.2314	$91,739

CAPITAL COST	**$ 4,461,686**
AVERAGE ANNUAL O&M	**$ 431,183**
TOTAL PRESENT WORTH	**$ 11,754,246**

STATUTORY DETERMINATIONS

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve adequate protection of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences. These specify that when complete, the selected remedial action must comply with ARARs under Federal and State environmental laws, unless a statutory waiver is justified. The selected remedy must also be cost effective and utilize permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduce the toxicity, mobility or volume of hazardous substances, pollutants and contaminants. The following sections discuss how the selected remedy, where applicable, meets the statutory requirements and preferences.

A. Protection of Human Health and the Environment

The selected remedy will provide for protection of human health by remediating contaminated soils which would continue to leach into groundwater and contaminate a drinking water aquifer, and by remediating the contaminated groundwater.

The selected remedial alternatives are proven and reliable methods for removing Volatile Organic Compounds (VOCs) from both soils and groundwater. The remedial objective of this operable unit is to restore both the contaminated site soils and the groundwater aquifer to health based cleanup levels for all contaminants of concern. The first operable unit, the air stripping of the city water supply, will continue to operate in concert with the remedial alternative selected in this Record of Decision until all cleanup objectives are achieved. If additional sources of soil contamination are identified, a third operable unit will then address those areas.

Implementation of the selected alternative will reduce and control potential risks to human health posed by exposure to contaminated groundwater and contaminated soil/sediment. Extraction and treatment of contaminated groundwater to meet Groundwater Cleanup Standards will reduce the potential excess lifetime cancer risk due to ingestion of contaminated groundwater from the unacceptable risks currently posed (e.g., 8×10^{-4}) by groundwater contaminants to a maximum risk for individual carcinogenic chemicals of approximately 1×10^{-6}. If all carcinogens were treated to the 1×10^{-6} level for the individual carcinogenic chemicals, the maximum cumulative risk would be approximately 1×10^{-5}, which is an acceptable level.

Institutional controls will provide short-term effectiveness for the prevention of drinking contaminated groundwater until the Groundwater Cleanup Standards are met. Air monitoring will be conducted during the remediation to ensure that air quality is not adversely impacted by the remedial action. The selected remedy also protects the environment by reducing the potential risks posed by site chemicals discharging to the wetlands (by discharge to the U.S. 10 Drainage Ditch, which empties into the wetlands area) and to surface water (the Tobacco

River).

Treatment of contaminated soil/sediment by Soil Vapor Extraction, in addition to reducing any potential further risk posed by direct contact exposure to contaminated soil/sediment, will reduce groundwater contaminant loading to the usable aquifer allowing the restoration of the aquifer within a reasonable time frame.

No unacceptable short-term risks will be caused by implementation of the remedy. The community and site workers may be exposed to noise and dust nuisances during construction of the soil vapor extraction and groundwater extraction systems. Mitigative measures will be taken during remedy construction activities to minimize the noise and dust impacts of construction upon the surrounding community.

Soil Vapor Extraction and groundwater treatment using UV-photochemical oxidation should not present short-term risks due to VOC air emissions if properly designed and monitored. Standard safety programs should manage any short-term risk of accidents.

B. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

The selected remedy is designed to meet all applicable or relevant and appropriate requirements (ARARs) of Federal and more stringent state environmental laws. The following discussion provides details of ARARs that will be met by the selected alternative.

a. Chemical-specific ARARs

Chemical-specific ARARs regulate the release to the environment of specific substances having certain chemical characteristics. Chemical-specific ARARs typically determine the extent of cleanup at a site.

i. Soils/Sediments

No Federal chemical-specific standards exist for soils and sediments.

The Michigan Environmental Response Act 307 of 1982, as amended (Act 307), provides for the degree of cleanup of contaminated sites within the State; therefore, Act 307 is applicable or relevant and appropriate to the Clare Water Supply Site. The U.S. EPA considers the substantive portions of the Act 307 rules to be ARARs for the remedial action at this site. These rules provide, inter alia, that remedial actions shall be protective of human health, safety, the environment, and the natural resources of the State. To achieve the standard of protectiveness, Act 307 rules specify that a remedial action shall achieve a degree of cleanup under either Type A (cleanup to background levels), Type B (cleanup to risk-based levels), or Type C (cleanup to risk-based levels under site-specific considerations) criteria.

The U.S. EPA has determined that the appropriate cleanup standards for soils and sediments would be derived under Type B criteria. This determination is based upon the consideration of projected land use in the Clare area and of protection of the environment. The Type B criteria for carcinogens are based on the reduction of the concentrations of hazardous substances to levels which pose an individual excess lifetime cancer risk of 1×10^{-6}, using the standardized exposure assumptions in the rules.

The U.S. EPA has determined that application of Type B criteria would be the appropriate cleanup response for the contaminated soils and sediments up to 25 feet in depth since these soils, which constitute the primary source, are within the unsaturated zone or will be able to be dewatered. Soils located at depths greater than 25 feet are in continuous contact with groundwater. These saturated soils will not be amenable to treatment using Soil Vapor Extraction because of the difficulty in dewatering saturated soils below this depth. However, since the soil cleanup standards are intended to be protective of groundwater, the measure of whether or not soils have been remediated adequately will be the achievement and maintenance of groundwater cleanup levels. In the event that groundwater cleanup levels are not being maintained or significantly reduced after the soil vapor extraction activity has exhausted its ability to extract volatile organics from the soil, an enhancement to the soil vapor extraction system, including but not limited to, in-situ bioremediation, steam injection or air sparging shall be evaluated and considered for addition to the remedy.

ii. Groundwater

Federal ARARs

Maximum Contaminant Levels (MCLs) and, to a certain extent, Maximum Contaminant Level Goals (MCLGs), the Federal drinking-water standards promulgated under the Safe Drinking Water Act (SDWA), are applicable to municipal water supplies servicing 25 or more people. At the Clare Water Supply Site, MCLs and MCLGs are applicable or relevant and appropriate, since the aquifer is a Class I source which is being used for drinking water in Clare. MCLGs are relevant and appropriate when the standard is set at a level greater than zero (for non-carcinogens), otherwise, MCLs are relevant and appropriate. The area of compliance for Federal drinking-water standards is anywhere within the area of the contaminant plume.

At the Clare Water Supply Site, the U.S. EPA has determined that cleanup to MCLs and non-zero MCLGs would not be protective, since the residual risk would fall outside of the range the U.S. EPA considers to be protective. Consequently, risk-based cleanup standards are necessary to achieve protectiveness.

State ARARs

The State of Michigan is authorized to administer the implementation of the Federal SDWA. The State has also promulgated MCLs under Michigan Act 399 (the Michigan Safe Drinking Water Act). Act 399 is applicable to the site since the aquifer is currently being utilized by the municipal water supply and because the affected homes and businesses are connected to the municipal water supply.

As above, Michigan Act 307 is applicable or relevant and appropriate to the Clare Water Supply Site. The U.S. EPA has determined that standards for groundwater cleanup, that are found under the Type B criteria, would be protective.

Finally, the upper aquifer discharges groundwater to the surface at a point shown in Figure 3. The U.S. EPA has determined that Type B criteria would provide for the protection of surface water quality, in turn, protecting human health and the environment. There are several compounds for which such discharge has a more stringent standard as discussed above in the section of this ROD entitled "Cleanup Levels Where Groundwater Discharges to Surface Water" and Table 5. The chosen remedy will attain these standards.

iii. Surface Water

Federal ARARs

Surface water quality standards for the protection of human health and aquatic life were developed under section 304 of the Clean Water Act (CWA). The Federal Ambient Water Quality Criteria (AWQC) are nonenforceable guidelines that set pollutant concentration limits to protect surface waters that are applicable to point source discharges, such as from industrial or municipal wastewater streams. At a Superfund site, the Federal AWQC would not be applicable except for pretreatment requirements for discharge of treated water to a Publicly Owned Treatment Works (POTW). CERCLA (section 121(d)(1)) requires the U.S. EPA to consider whether AWQC would be relevant and appropriate under the circumstances of a release or threatened release, depending on the designated or potential use of groundwater or surface water, the environmental media affected by the releases or potential releases, and the latest information available. Since the aquifer is a current and potential source of drinking water and since treated water may be discharged to the Tobacco River or to injection wells (if treatment criteria are met), AWQC adopted for drinking water and AWQC for protection of freshwater aquatic organisms are relevant and appropriate to the point source discharge of the treated water into the Tobacco River.

State ARARs

Portions of the Water Resources Commission Act 245 (Michigan Act 245) of 1929, as amended, establish surface water-quality standards to protect human health and the environment. The State administers the NPDES program under Part 21 of Michigan Act 245; therefore, Part 21 of Act 245 would be applicable to the direct discharge of treated water to the Tobacco River or to a clean aquifer, to the indirect discharge through groundwater movement to a surface water body, or to discharge to a POTW.

b. Location-specific ARARs

Location-specific ARARs are those requirements that relate to the geographical position of a site. These include:

Federal ARARs

Both RCRA (40 CFR 264.18(b) - hazardous waste storage - flood plain) and Executive Order 11988 - Protection of Flood Plains - are relevant and appropriate for this site, a portion of which is located within the mapped 100-year flood plain of the Clinton River. These regulations would require that the groundwater treatment system be located above the 100-year flood plain elevation (826.3 feet above mean sea level for the Tobacco River in Clare) and be protected from erosional damage. The regulations also require that any portion of a cap that is constructed within the 100-year flood plain be adequately protected against a 100-year flood event (e.g., geotextiles should be used to secure topsoil, etc.)

Section 404 of the CWA regulates the discharge of dredged or fill material to waters of the United States, including wetlands. A portion of the Clare Water Supply Site includes wetlands which are regulated under section 404 of the CWA; therefore, the substantive requirements of section 404 would be relevant and appropriate to the remedial action at the site.

Executive Order 11990 - Protection of Wetlands - is an applicable requirement to protect against the loss or degradation of wetlands. As presented above, implementation of the groundwater extraction system could potentially have a negative impact on the wetlands at the Clare Water Supply Site. The scope of the impact has not yet been determined however monitoring of the integrity of the wetlands shall be implemented along with this remedial action. Mitigative efforts would be applied to the cleanup if an impact is seen on the wetlands. In the event of a negative impact upon the wetlands, Executive Order 11990 may require these resources to be replaced.

State ARARs

The Goemaere-Anderson Wetland Protection Act 203 of 1979 (Act 203) regulates any activity which may take place within wetlands in the State of Michigan. Act 203 is applicable to the remedial action at the Clare Water Supply Site; it may also require the replacement of adversely impacted wetlands with comparable resources.

The Inland Lakes and Streams Act 346 of 1972, as amended, regulates inland lakes and streams in the State. Act 346 would be applicable to any dredging or filling activity on the Tobacco River bottomlands.

The Soil Erosion and Sedimentation Control Act 347 of 1972 regulates earth changes, including cut and fill activities, which may contribute to soil erosion and sedimentation of surface waters of the State. Act 347 would apply to any such activity where more than 1 acre of land is affected or the regulated action occurs within 500 feet of a lake or stream. Act 347 would be applicable or relevant and appropriate to remedial action activities should these actions impact the Tobacco River, which is less than 500 feet from the Clare Water Supply Site.

c. Action-specific ARARs

Action-specific ARARs are requirements that define acceptable treatment and disposal procedures for hazardous substances.

Federal ARARs

RCRA requirements are applicable to the soil contaminated with RCRA-listed or characteristic hazardous wastes when the soils are excavated and managed (treated, disposed, or stored), as defined by RCRA, during the cleanup. RCRA Land Disposal Restrictions (LDR or Land Ban) would not be applicable as long as no "placement" of the material occurs at this site. However, if implementation of Alternative #4A brings contaminated soil to the surface, either returned by the augers or excavated from the trenches, which can not be managed and treated within the area of contamination, and this material has to be moved from that area of contiguous contamination and be treated, stored or disposed of elsewhere, then the LDRs will be applicable to that material.

In its pure form, waste organic solvent may be a characteristic waste (ignitibility) and, in its present form (mixed with soil and debris), the waste solvents would be expected to fail the TCLP test; and therefore, exhibit a property of characteristic waste. As of this date, no testing has shown that the Clare Water Supply Site wastes exhibited a property of characteristic waste as defined by RCRA using the TCLP test for organics. RCRA Subtitle C requirements, including LDR, will be relevant and appropriate if the solvent wastes are excavated and managed assuming they are RCRA wastes.

The selected remedy may also require storage or disposal of hazardous waste because the groundwater treatment system or soil vapor extraction system may require emission control units to capture or contain volatile organics derived from aeration of the contaminated groundwater or soil. The RCRA waste generation and temporary storage regulations under 40 CFR Part 262 would then be applicable to that action. For example, activated carbon canisters utilized as emission controls would be managed, when spent, as a characteristic waste if the waste canisters were to fail the TCLP test.

Additional Federal action-specific ARARs are found in the FS.

State ARARs

The State of Michigan is authorized to administer RCRA within the State. Under the Hazardous Waste Management Act 64 of 1979, as amended, the State regulates the generation, transport, treatment, storage, and disposal of hazardous waste. Act 64 also regulates the closure, and the postclosure care, of hazardous waste disposal facilities in the State. As with RCRA, above, Act 64 is applicable to the treatment or storage of hazardous landfill contents and/or hazardous residuals from on-site treatment units.

Parts 4, 9, and 21 of the Water Resources Commission Act 245 of 1929, as amended, establish rules for water quality by prohibiting injurious discharges to surface water. These rules would be applicable to the discharge of treated groundwater to the Tobacco River or to the injection wells.

As described earlier in this document, the Michigan Environmental Response Act 307 of 1982, as amended (Act 307), provides for the degree of cleanup of contaminated sites within the State. The U.S. EPA has determined that the substantive portions of the Act 307 rules are applicable or relevant and appropriate to the Clare Water Supply Site. The Act 307 rules require that remedial actions shall be protective of human health, safety, the environment, and the natural resources of the State. To achieve this standard of protectiveness, the Act 307 rules require that a remedial action achieves a degree of cleanup under either Type A (cleanup to background levels), Type B (cleanup to risk-based levels), or Type C (cleanup to risk-based levels under site-specific considerations) criteria.

C. Cost-Effectiveness

Cost-effectiveness compares the effectiveness of an alternative in proportion to its cost of providing environmental benefits. Table 7 lists the costs associated with the implementation of the remedies.

The selected remedy is cost-effective. The combined remedy of Alternatives #4A and #5B provide for the maximum use of treatment of all the alternatives for a capital cost of $4,267,063 and average annual operation and maintenance costs of $ 431,582.

D. Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable (MEP) at this time. This finding was made after evaluation of the protective and ARAR-compliant alternatives for the Clare Water Supply Site remedial action and comparison of the "trade-offs" (advantages versus disadvantages) among the remedial alternatives with respect to the five balancing criteria (see above).

The NCP established the U.S. EPA policy of giving priority to long-term effectiveness and to reduction of toxicity, mobility, and volume (TMV) at a site, stating that long-term effectiveness and reduction of TMV through treatment are generally the key decisional factors to be considered at Superfund sites. Once the threshold criteria of protection of human health and the environment and ARARs-compliance were satisfied, a key criterion used in remedy selection for the Clare Water Supply Site was short-term effectiveness, rather than an emphasis on the immediate reduction of TMV through treatment. Long-term effectiveness was also emphasized by providing for acceptable residual risk levels in the groundwater and soils at the site.

U.S. EPA and the State of Michigan have determined that the selected remedy represents the maximum extent to which permanent solutions can be utilized in the most cost effective manner to address soil and ground water contamination in the affected area. Of the alternatives that are protective of human health and the environment and comply with ARARs, U.S. EPA and the State have determined that the selected remedy provides the best balance of tradeoff in terms of protectiveness, long-term effectiveness, short-term effectiveness, implementability and cost.

The remedial alternatives selected in this Record of Decision address the reduction in toxicity, mobility or volume achieved through treatment and the statutory preference for treatment as a principal element of the selected remedy.

E. Preference for Treatment as a Principal Element

The principal threats at the Clare Water Supply Site is the solvent and oil-contaminated soils and sediments, since the contaminants are highly concentrated and would continue to leach into the groundwater if left untreated.

The selected remedial alternative achieves to the maximum extent possible treatment of all VOCs which are removed from the soils and groundwater. The soil treatment system will rely upon vapor phase carbon adsorption and off-site thermal destruction of the VOCs while the groundwater treatment system will rely upon photochemical oxidation to destroy all the VOCs removed from the groundwater at the site. The component of the selected remedy for soils (Soil Vapor Extraction) also treats more contaminated soil than the other soils alternative since SVE can be performed on contaminated soils located under buildings while the excavation alternative (4B) will not be able to treat the contaminated soils which are located under buildings (roughly 15,000 cubic yards).

Alternative 4A treats the soil/sediment principal threat and Alternative 5B addresses the contaminated groundwater primary risk through treatment. Consequently, the combined remedy selected for the Clare Water Supply Site fully satisfies the statutory preference for treatment as a principal element of the remedy.